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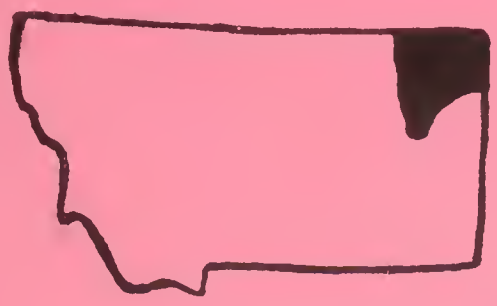
WATER QUALITY INVENTORY AND MANAGEMENT PLAN

LOWER MISSOURI RIVER BASIN
MONTANA



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WATER QUALITY INVENTORY AND MANAGEMENT PLAN
LOWER MISSOURI RIVER BASIN, MONTANA

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I. INTRODUCTION

This report presents information related to water quality and water quality management in the Lower Missouri River basin (Figure 1). This basin is one of sixteen basins designated by the state of Montana for preparation of water quality management plans. The Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) have directed states to prepare such plans as part of a national program for controlling water pollution.

The objectives of this effort are to provide the state with water quality data and related information to:

1. Determine the water quality characteristics of all natural and wastewaters.

2. Determine what factors, both natural and man-made, affect the quality of waters in the basin.

3. Develop a management strategy for maintaining and enhancing the quality of waters in the basin.

4. Provide information needed to determine whether Montana's water quality standards are being and will continue to be met.

Also included is a description of phyiscal characteristics of the basin. The general methodology used in this study was the compilation and evaluation of existing water quality data and related information. Where information was deficient, field investigations and water and wastewater sampling and analyses were completed to obtain the needed information.

This investigation does not present a detailed analysis of the area's resources but summarizes water quality related information. As additional information becomes available, the Lower Missouri basin water quality management plan will be revised and updated as part of Montana's continuing planning process.

Assistance in obtaining information for this report was obtained from a number of agencies and persons. The Montana Department of Natural Resources and Conservation provided information on land use, water use, economy and population.

United States Geological Survey (USGS) personnel provided unpublished water quality data on stations maintained by the USGS. Federal waste discharge permit information was obtained from Richard T. Montgomery, U. S. Environmental Protection Agency state engineer for Montana.

II. SUMMARY AND CONCLUSIONS

Waters of the Lower Missouri River basin, in general, are only of fair quality, being high in sodium and sulfates. Samples were not collected during spring runoff, but it is felt that, as in other basins, fecal coliform concentrations and suspended solids would increase during runoff conditions. Three municipal discharges, Poplar, Reserve, and Brockton, do not meet minimum treatment requirements and require corrective action. There is one known agricultural and no known industrial discharges in the basin. Discharge permits have been issued to nine municipalities that have discharge capabilities. Permits have been drafted for three Indian communities and will later be issued. Compliance schedules have been established for six municipal discharges and the agricultural discharge. Compliance schedules will be effective for the three Indian communities when the permits are issued. Secondary treatment is required of all municipal discharges by July 1, 1977. Limited data indicate that Big Muddy Creek, the Poplar River, and Redwater River do not meet state water quality standards because of high fecal coliform concentrations. Big Muddy Creek, the Poplar River, and the Redwater River are, at times, unsuitable for irrigation and, therefore, at times do not meet water quality standards. Work is needed on these streams to determine the causes of the poor water quality.

Municipal facility investments needed to achieve secondary levels of treatment for public sewage treatment facilities in the basin are estimated at approximately $750,000. Flaxville presently has a $125,000 grant and is constructing a new sewer system with treatment facilities. Poplar has a $15,750 grant for a facilities plan.

A surveillance plan for continued monitoring of water quality in the Lower Missouri River basin is described in the plan.

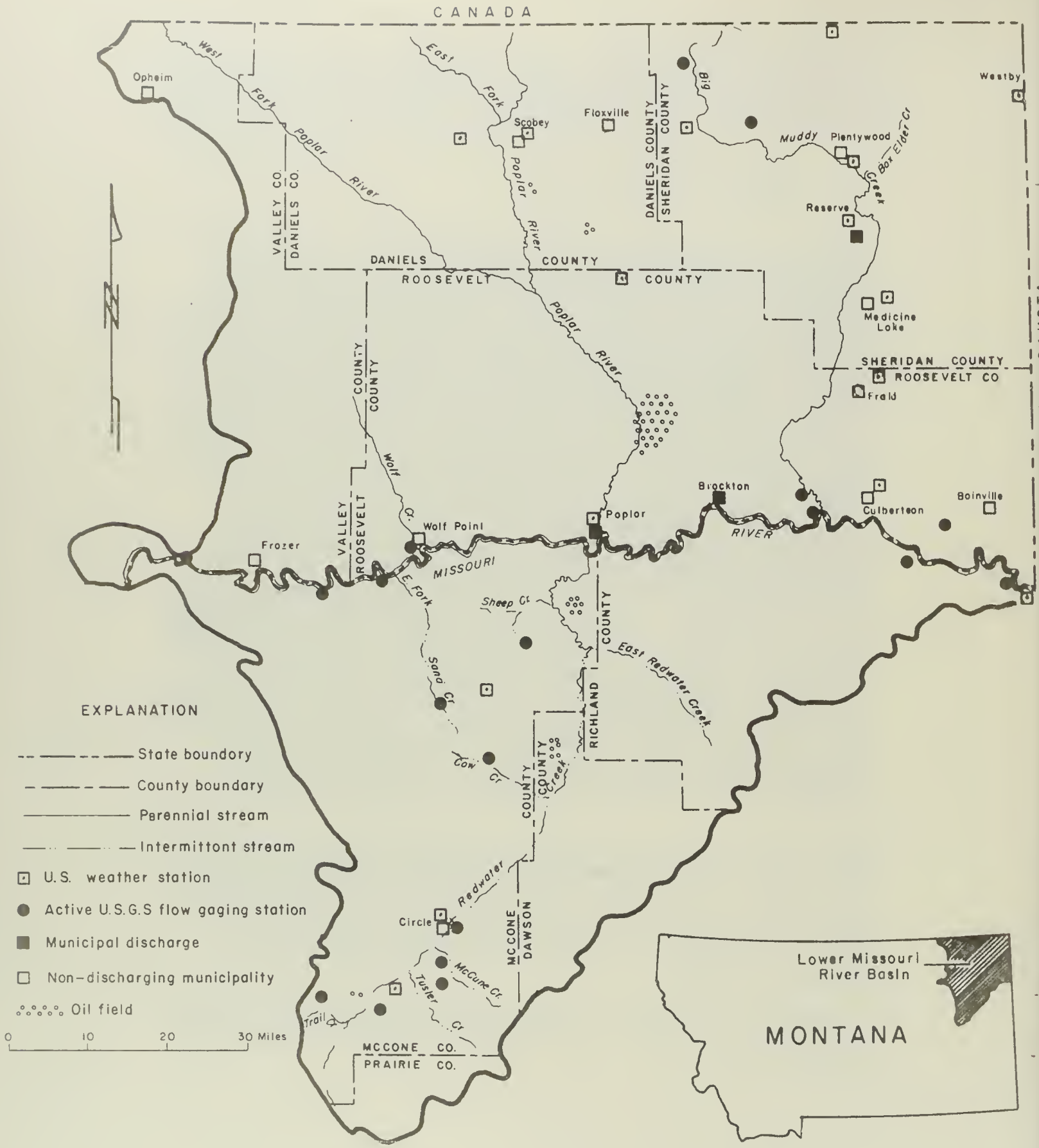

Figure 1 — Sketch map showing Lower Missouri River Basin

III. RELATED INVESTIGATIONS AND PLANS

TECHNICAL INVESTIGATIONS

A limited number of publications are available for the Lower Missouri River. Montana State Board of Health Progress Report No. 60-1 (1960) describes some of the problems that existed in 1960 and recommends solutions to these problems. This report also was an attempt to classify stream waters as to the quality.

In A COMPREHENSIVE PROGRAM FOR CONTROL OF WATER POLLUTION - MISSOURI DRAINAGE BASIN (1953), it was concluded that:

1. This region is generally deficient in water resources.

2. Except in major rivers, stream flow is low and often approaches zero.

3. This area has a large waterfowl population.

4. There is no significant interstate pollution.

R. W. Love, Lewis A. Young, and H. O. Hartung (1967) concluded that:

1. The primary and most important use of the Missouri River is for drinking and public water supply uses.

2. Missouri River water should be free from substances objectionable and hazardous to health and consumer acceptance.

3. Missouri River water quality should, at all times, be at least as good as the present average quality, to be measured and judged first by its effect on drinking water potability, consumer acceptance, public health, and other public water supply requirements.

4. Cost of waste treatment should be the responsiblity of the polluter.

Herbert O. Hartung (1958) concluded that in the vicinity of St. Louis, Missouri, ammonia content and turbidity

are the primary water quality characteristics which have changed with the construction of reservoirs.

Both the Soil Conservation Service (SCS) and the Water Quality Bureau are presently conducting inventory work on the saline seep areas, and SCS personnel are conducting experiments on vegetation that is best adapted for saline soils and attempting to find best land use practices to control saline seep. Detailed information is not yet available from saline seep investigations.

AREAWIDE WASTE TREATMENT MANAGEMENT PLANS

There are no areawide waste treatment management plans in the Lower Missouri River basin under Section 208 of the Federal Water Pollution Control Act Amendments of 1972. None are anticipated in the next five years.

SECTION 201 FACILITY PLANS

No wastewater facility plans have been completed for any municipalities in the Lower Missouri River basin. Any sewage treatment facility construction grants awarded after July 1, 1974, will require, under the present federal grant program, a facility plan to be written by the municipality or its consulting engineers.

LEVEL B PLANS AND OTHER FEDERAL PLANS

The Montana Department of Natural Resources and Conservation has requested funding for Level B planning in the Lower Missouri River basin, but before fiscal year 1976, no money is anticipated for this planning.

IV. BASIN PHYSICAL CHARACTERISTICS

The Lower Missouri River basin (Figure 1 and Plate I) includes that portion of the Missouri River below Fort Peck Dam to the Montana-North Dakota boundary and associated tributaries, the Poplar River, Redwater River, Wolf Creek, and Big Muddy Creek. This basin, having a total area of approximately 10,000 square miles, includes the entire counties of Daniels, Sheridan, and Roosevelt, and approximately 18 percent of Valley County, 40 percent of Richland County, 18 percent of Dawson County, 77 percent of McCone County, and 3 percent of Prairie County. Topography in the basin varies from rolling hills and flat plains and is occasionally cut by stream valleys which sometimes form badland-type sharp pinnacles, bluffs, and steep banks. Elevations vary from 3,500 feet above sea level in the Big Sheep Mountains of McCone County to 1,900 feet above sea level in the eastern boundaries of Roosevelt and Richland counties.

In this basin, there are two municipal discharges, ten potential municipal discharges, 13 water quality monitoring stations, 35 stream flow gaging stations, and 18 weather stations (Plate I). The Missouri River drainage waters in the basin have been classified as B-D3 by the state of Montana, except for Wolf Creek and Poplar River drainages, which have been classified as B-D2. Waters classified as B-D2 are to be maintained in a quality suitable for drinking, culinary, and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection, and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

Waters classified as B-D3 are to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection, and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

Detailed water quality criteria for all waters in the basin are shown in Appendix B. Limited data obtained during this investigation suggested that the Redwater River, the Poplar River, and Big Muddy Creek do not meet the state water quality standards for coliform count, and it is felt more work should be done on these streams to confirm the initial data and to investigate possible problems.

CLIMATE

A continental type climate is typical for the Lower Missouri River basin with winters being cold, summers warm, and springs wet. Three weather producers are:

1. Arctic invasions during the winter.

2. Active low pressure areas during the spring.

3. Summer thunderstorms.

Precipitation amounts vary from 10 to 14 inches annually in Valley County to 17 inches annually near the Sheridan County-North Dakota boundary. Most of this precipitation falls as gentle rains during the growing season months of April through June. Dawson County snow fall is not considered heavy, averaging about 28 inches in the Yellowstone valley with heavier amounts in the hills. Valley County averages 25 to 35 inches of snow, which can accumulate in long-lasting snow drifts. Differences in latitude from north to south are responsible for the greatest climatic variations, although the hill-valley effects influence local weather conditions and temperature extremes.

Operating weather stations in the basin are listed in Table 1. In cooperation with the National Oceanographic and Atmospheric Administration (NOAA), stations are maintained by private individuals, a U. S. border station, and various other organizations, including McCone Electric Coop, U. S. Army Corps of Engineers, U. S. Fish and Wildlife Service, U. S. Customs Service, Bureau of Indian Affairs, and the Lower Yellowstone irrigation project. Basin weather can best be characterized by data collected at Circle. Normal monthly temperatures and precipitation for Circle from 1931 to 1960 are shown in Figure 2.

TABLE 1. WEATHER STATIONS IN THE LOWER MISSOURI RIVER BASIN

Station	Lat.	Long.	County	Temp.	Precip.	Gaging	Record Years
Brockway 3WSW	47°17'	10°54'9"	McCone	X	X	Non-recording	14
Circle	47°26'	10°53'5"	McCone	X	X	Non-recording	11
Fort Peck Power Plant	48°01'	10°62'4"	McCone	X	X	Both	17
Four Buttes	48°49'	10°53'7"	Daniels		X	Recording	
Froid	48°20'	10°43'0"	Roosevelt		X	Recording	
Lustre 4NNW	48°27'	10°55'6"	Valley	X	X	Non-recording	51
Medicine Lake 3SE	48°29'	10°42'7"	Sheridan	X	X	Non-recording	59
Nohly 4NW	48°02'	10°40'8"	Richland	X	X	Non-recording	23
Opheim 10W	49°00'	10°62'3"	Valley	X	X	Non-recording	17
Plentywood	48°47'	10°43'3"	Sheridan		X	Non-recording	26
Poplar	48°07'	10°51'2"	Roosevelt	X	X	Non-recording	88
Raymond Border Station	49°00'	10°43'5"	Sheridan	X	X	Non-recording	
Redstone	48°50'	10°45'7"	Sheridan	X	X	Non-recording	
Reserve 14W	48°34'	10°44'8"	Sheridan		X	Recording	
Scobey	48°47'	10°52'5"	Daniels	X	X	Non-recording	
Vida	47°50'	10°52'9"	McCone	X	X	Non-recording	
Westby	48°52'	10°40'3"	Sheridan	X	X	Both	
Wolf Point 5ESE	48°05'	10°53'2"	Roosevelt	X	X	Non-recording	

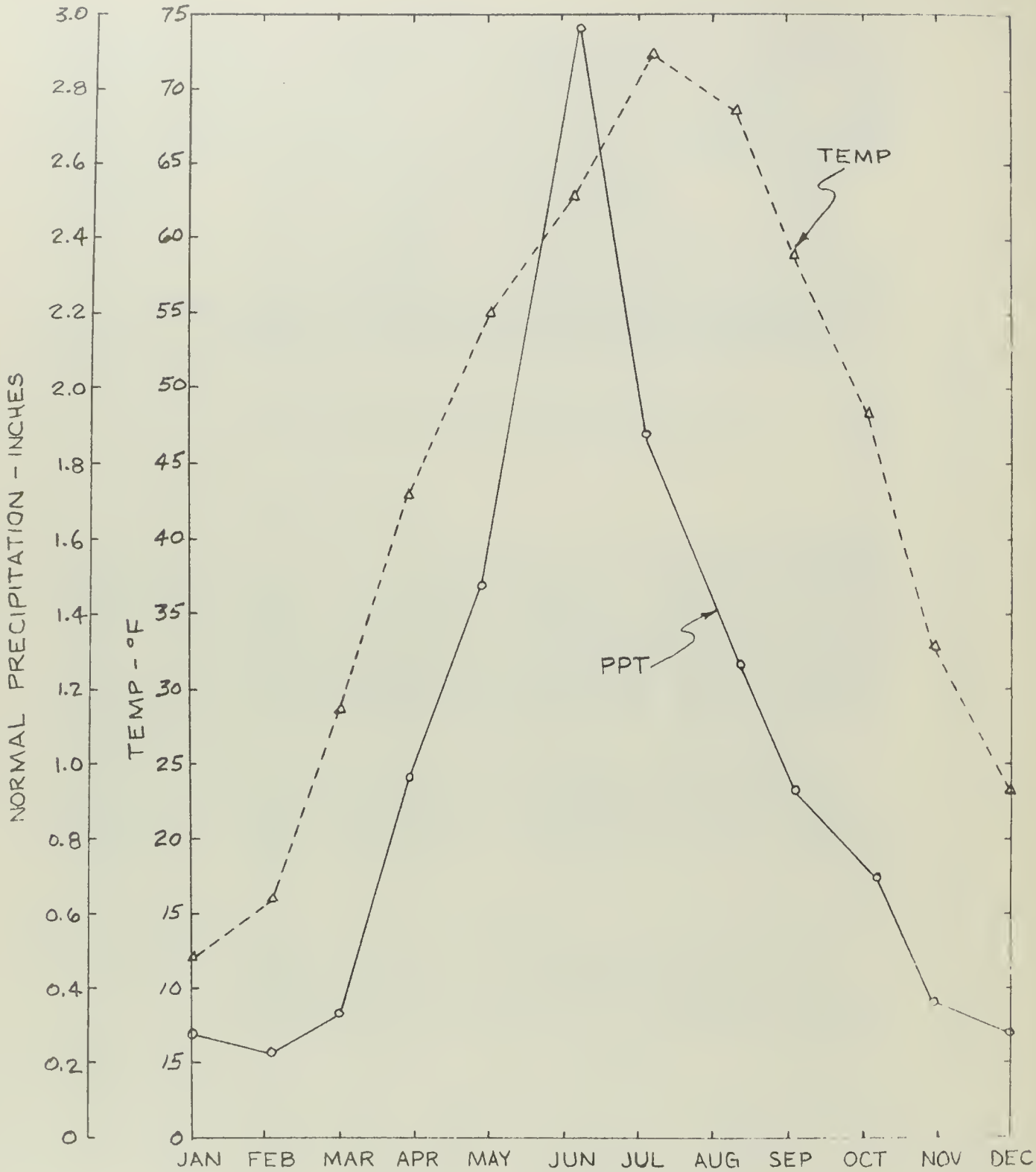

FIGURE 2. AVERAGE TEMPERATURES AND NORMAL PRECIPITATION FOR THE LOWER MISSOURI RIVER BASIN (Based on NOAA data for Circle, Montana)

HYDROGEOLOGY

Groundwater is the most widely used source of domestic and stock water in the Lower Missouri River basin. Groundwater also supplies some industrial, irrigation, and municipal water needs. Groundwater is widely available within the basin and is used by a large number of people and constitutes a valuable water resource. The occurrence, availability, and quality of groundwater within the basin is closely related to geological conditions.

The geological history of the Lower Missouri basin includes extensive periods of sedimentation, regional uplift, erosion, and glaciation. All bedrock formations exposed in the basin are of sedimentary origin and range in age from Upper Cretaceous (70 to 100 million years old) to Recent (less than 20,000 years old). During most of Cretaceous time, thick sequences of marine sediments were deposited, followed by deposition of thick, non-marine, coal-bearing sediments during the late Cretaceous and early Tertiary time (50 to 70 million years old). In the geologic past, a large area near the present town of Poplar was uplifted, forming the Poplar Dome. After uplift, erosion removed much of the uplifted sediments and reduced the area to a plain. Structurally, the basin is on the western edge of the Williston Basin, and most formations gently dip eastward. The basin also has been influenced by geologic faulting.

During the Pleistocene epoch (20,000 to 1,000,000 years ago) most of the basin was covered by large continental ice sheets. The ice sheets blocked the Missouri River and its tributaries creating numerous glacial lakes which eventually flowed southeastward across drainage divides into the Yellowstone and Little Missouri River basins.

Geological units of interest to groundwater resources in the basin include Recent alluvium, Pleistocene glacial deposits, the Fort Union Formation, and Flaxville Gravel of Tertiary age, the Hell Creek Formation, Fox Hills Sandstone, and Judith River Formation of Cretaceous age. Beneath these bedrock units is about 8,000 to 10,000 feet of sedimentary formations, some of which contain groundwater. The depth of these formations and/or presence of poor quality water has restricted groundwater development beneath the Judith River Formation.

Recent alluvium present along flood plains of the Missouri River and its tributaries is composed chiefly of silt, sand with local lenses of gravel. The alluvial deposits range in thickness from a few feet in the valleys of smaller tributaries to over 100 feet beneath the Missouri River flood

plain. Water from the alluvium generally is of a fair quality, and the alluvium usually will yield adequate quantities of water for stock and domestic use. Wells drilled into thick gravel zones in the alluvium generally will yield moderate to large quantities of good to poor quality water.

Glacial deposits of Pleistocene age cover much of the basin. The glacial deposits include till, outwash channel and lake deposits. Glacial till is a hetrogeneous, compacted mixture of silt, clay, gravel, sand, and boulders. The till deposits range in thickness from several feet to over 200 feet. Wells in glacial till usually yield small amounts of poor quality water. Outwash channels derived from deposition of sand and gravel of glacial meltwater channels are present in the till. These deposits, consisting of sand and gravel, were sufficiently thick to yield moderate to large quantities of waters to wells.

An extensive area in the north central portion of the basin is covered by the Flaxville Gravel. This formation generally is 30 to 50 feet thick but may be thicker locally. The Flaxville Gravel consists of silt, sand, pebbles, and cobbles. The Flaxville is a good aquifer where there is sufficient saturated thickness, and quality of water from this formation is fair to good.

The Fort Union Formation of Tertiary age underlies much of the eastern half of the basin. The Fort Union consists of discontinuous sandstone and interlayered clay, silt, lignite, and shale. The full thickness of the Fort Union is about 1,400 feet, but erosion has reduced this thickness in much of the basin, particularly in the western part of the basin. The upper and lower members of the Fort Union Formation contain sandstones that generally yield fair to poor quality water in quantities suitable for stock and domestic use. Bedrock formations, including the Hell Creek Formation, Fox Hills Sandstone, and Judith River Formation, generally are present beneath the Fort Union Formation in the western portion of the basin and are present beneath glacial deposits and Recent alluvium. These bedrock formations generally yield small to moderate quantities of fair to poor quality water to wells.

Pollution of groundwater is not known to be widespread in the Lower Missouri River basin. Sewage stabilization lagoons generally have seepage into groundwater and create localized areas of groundwater pollution. There have been, however, no reported problems due to lagoon seepage for sewage lagoons in the basin. Septic tank drainfields and

subsurface sewage disposal can create groundwater pollution where there are large numbers of septic tanks and individual water supplies using wells. Septic tanks are also a problem along streams where gravels are very pervious, allowing septic wastes to enter into streams. There have been few problems from septic tanks identified within the Lower Missouri basin. South of Westby, Montana, a problem of salinity in wells has been identified, and these salinity problems are thought to be due to disposal of saline waters from oil production in the area.

Another groundwater pollution problem in the Lower Missouri basin is saline seeps. Saline seeps originate when groundwater percolates through salt-laden geological material, thereby dissolving a salt load from these materials and redepositing the load in areas of groundwater discharge. A number of saline seep problems have been identified in the basin; however, the exact location and magnitude of the seep problems have not been clearly demonstrated.

SOILS

The major event that influenced soils of the Lower Missouri River basin was the advance and recession of continental glaciers. Soils are generally underlain by glacial till, the nonsorted, nonstratified material carried or deposited by glaciers. Fine materials, silt and clay, were often deposited in bodies of still water, and coarse materials were deposited in outwash channels. Extensive post-glacial sedimentation resulted in filling of many stream valleys with alluvium. The primary non-glaciated area in the river basin is the upper Redwater Creek. Bedrock, which is exposed in places, consists of shale and sandstone layers.

The smooth and dissected flood plains of the Missouri River and its tributaries are dominated by well to poorly drained, deep, calcareous soils with silt loam to clay surfaces and subsoils, and varying degrees of subsoil stratification and surface salinity. Some of these soils can present a high erosion hazard. In general, these soils are not under cultivation except some of the lighter textured loams that are watered by irrigation or subirrigation. In general, the heavier soils have a low-carrying capacity for livestock.

The best of the agricultural soils in the river basin are characterized by soils with loam and clay loam surfaces and clay loam subsoils. They are well-drained and occur on nearly level to strongly sloping glacial till uplands. These soils can present a moderate erosion hazard under improper management.

Small areas of deep, poorly-drained clay soils occur on plains formed from lake-deposited sediments. High erosion hazards exist on these soils. Drainage is generally too poor for successful dryland agriculture.

Other good agricultural soils of the glacial till uplands are characterized by well-drained, deep soils with sandy loam surface layers and sandy clay loam to loam sand subsoils. A wind erosion hazard exists if the land is left in fallow for extended periods. On the shale uplands, well-drained soils with silt loam surfaces and silty clay loam subsoils have developed. Shale is usually encountered at 20 to 40 inches from the surface. These soils are used for farming and grazing and present a moderate erosion hazard.

Light colored, well-drained, calcareous clay loam soils have developed on steep, hilly moraines and very poorly-drained clay loam soils in kettles. These soils are generally used for grazing and present moderate to severe erosion hazards. On gently sloping fans and terraces, well-drained, deep soils with loam to silty clay surface layers and clay loam to silty clay subsoils have been developed. Clay loams with moderate salinity have developed in poorly-drained areas. Some of the well-drained soils are used for dryland farming. The erosion hazard is generally moderate. Shallow calcareous clay loam soils on glacial till and rock outcrops on very steep slopes of rough, broken land are commonly termed "breaks." These soils are not farmed and present a severe erosion hazard.

The non-glaciated upper Redwater Creek is underlain by the Fort Union Formation, which is of Tertiary age. Light colored loamy soils occur on the rolling and steep shale uplands and sandy and gravelly soils on hilly sandstone uplands. These soils present moderate to severe erosion hazards, depending on management.

LAND USE

Based on 1967 land use data as presented in the MONTANA SOIL AND WATER CONSERVATION NEEDS INVENTORY, the largest land use in the basin is privately owned range land, which constitutes approximately 42.4 percent of the total land resource. The next largest use classification is cropland, which accounts for 33.8 percent of the basin. Federal non-crop, which includes all federal lands in the basin that are not being farmed, accounts for 19.7 percent of the basin. It can be assumed that the majority of this land is being used as range land. Other major land uses within the basin are as follows:

urban and built-up area - 1.0 percent, forest - 0.5 percent, small water area under 40 acres in size - 0.2 percent, and pasture - 1.8 percent. The remaining 0.6 percent is considered as unusable. An example of this type of area would be rock outcrops.

Irrigated lands account for 47,429 acres of the basin, with an additional 974,843 acres considered to be irrigable. This land falls in both the cropland and the pasture categories. Primary irrigated crops grown are hay and pasture grasses. Grain and hay are the major dryland crops in the basin.

Land ownership patterns vary greatly from county to county, with the majority being in private ownership. The exception to this is in Roosevelt and Valley counties where Indian lands predominate. Approximately 75 percent of the 2,093,000-acre Fort Peck Indian Reservation lies within the basin.

WATER USE

The largest water use in the basin is for irrigation, which diverts approximately 269,000 acre-feet annually. Of this figure, 189,000 acre-feet is delivered to the farm and 127,000 acre-feet is depleted in the process. A total of 142,000 acre-feet is return flows. These figures are all approximate and are based on 70 percent delivery stream efficiency and a 35 percent farm efficiency.

Municipal water use in the basin accounts for 2,545 acre-feet annually. There are a total of 14 communities served by municipal systems with all of them except Culbertson being dependent upon groundwater sources for supply.

Other water usage in the basin, i.e., industrial and stock water, is negligible.

POPULATION AND ECONOMY

This basin, lying in the northeast corner of the state, contains all of Daniels, Sheridan and Roosevelt counties; a large part of McCone and Richland counties; and parts of Dawson, Prairie and Valley counties. For this profile, 1970 census data from county census divisions have been summed to approximate the population and employment of the basin. According to the 1970 census, 1970 population of the basin was 26,680, with 23,585 classed as rural and 3,095 as urban. Wolf Point, in Roosevelt County, is the only community in the basin which the census considers urban.

Communities with 100 or more people are listed in Table 2 along with their 1970 population.

TABLE 2. COMMUNITIES OF 100 OR MORE PERSONS

Community	County	1970 Population
Flaxville	Daniels	185
Scobey	Daniels	1,486
Whitetail	Daniels	125
Richey	Dawson	389
Circle	McCone	964
Bainville	Roosevelt	217
Brockton	Roosevelt	401
Culbertson	Roosevelt	821
Froid	Roosevelt	330
Poplar	Roosevelt	1,389
Wolf Point	Roosevelt	3,095
Medicine Lake	Sheridan	393
Outlook	Sheridan	153
Plentywood	Sheridan	2,381
Westby	Sheridan	287
Fort Peck	Valley	625
Frazer	Valley	350
Opheim	Valley	306

Table 3 gives population and employment from 1930 to 1970 and projected to 1980 and 1985. Both have been somewhat erratic over the years but remaining near the same levels since 1950. Both are projected to remain essentially constant, with population increasing slightly and employment declining slightly. It should be noted, however, that some parts of the area, particularly McCone County, are underlain by substantial deposits of strippable lignite. The projections do not account for any increase in coal-based activity. Recent exploratory activity, as well as the announcement of a planned fertilizer/fuel plant by Burlington Northern, Inc., strongly highlight the very real potential that parts of the basin have for coal development. Just one significant coal mining and processing operation could change the complexion of any community in the study area.

TABLE 3. LOWER MISSOURI RIVER BASIN - POPULATION AND EMPLOYMENT
Historical and Projected
1930 to 1985

	1930	1940	1950	1960	1970	1980	1985
Population	34,987	31,249	27,899	31,345	26,680	27,423	27,119
Employment	12,376	8,927	9,276	9,663	8,929	8,642	8,442

Table 4 shows employment by gross sectors in 1970. The two major sectors are agriculture and services and other. As with virtually all of Montana, since 1930, agriculture has accounted for a declining number of jobs, and services produced an increasing number.

TABLE 4. EMPLOYMENT BY GROSS SECTORS
1970

Sector	Number	Percent of Total
Agriculture	2,464	27.6
Forestry and Fisheries	7	0.1
Mining	152	1.7
Construction	455	5.1
Manufacturing	310	3.5
Services and Other	5,541	62.1
TOTAL	8,929	100.0*

*Does not total 100.0 due to rounding.

Table 5 from the U. S. Department of Agriculture Conservation Needs Inventory shows several interesting features of the area. McCone County, which is south of the river, differs in several respects from the three counties north of the river. McCone County has relatively more pasture and range while the others have more cropland. Forest land is insignificant. Marketing receipts from crops are nearly twice those from livestock. Parts of the area north of the river are known nationwide for the production of very high protein hard red spring wheat.

Wholesale and retail trade is limited in the basin. Shoppers commonly travel to Glendive, Sidney, and Williston, North Dakota. For major shopping trips, many travel to Billings.

TABLE 5. LAND USE IN 1967 - DANIELS, McCONE, ROOSEVELT AND SHERIDAN COUNTIES - in Acres and Percent of Total(1)

County	Total Inventory	Cropland	Pasture	Range	Forest	Other
Daniels	911,938	543,166	4,550	352,896	0	11,326
	100%	59.6%	0.5%	38.7%		1.2%
McCone	1,395,207	493,585	56,003	839,223	4,453	1,943
	100%	35.4%	4.0%	60.2%	0.3%	0.1%
Roosevelt	1,501,677	731,915	20,090	722,902	8,745	18,025
	100%(2)	48.7%	1.3%	48.1%	0.6%	1.2%
Sheridan	1,047,532	638,310	32,500	368,081	641	8,000
	100%	60.9%	3.1%	35.1%	0.1%	0.8%

(1) U.S.D.A. MONTANA SOIL AND WATER CONSERVATION NEEDS INVENTORY, 1970.

(2) Does not total 100.0 percent due to rounding.

BIOLOGICAL CONDITIONS

Waters in this basin are generally warm-water habitats. There are good to marginal cold-water habitats in the Missouri River immediately below Fort Peck Dam and in some small streams and reservoirs. The Missouri River below Fort Peck Dam contains an abundance of rough fish, including carp, goldeye, river carpsucker, blue suckers, and sturgeon (Montana Fish and Game Department, 1961-1969). Sauger, walleye, channel catfish, paddlefish, and northern pike are the sport fish in the Missouri River below the dam and in the lower reaches of the Poplar River.

Wolf and Tule creeks contain self-sustaining brook trout populations. In addition, rainbow trout are stocked in Wolf Creek on a "put and take" basis. The foremost problem of these two streams is inadequate flows. However, the slightest decline in water quality would create unsuitable trout habitat.

Other tributaries such as Little Porcupine, Big Muddy, Prairie, Elk, Sand, Charlie, and Hardscabble creeks plus the Redwater River do not support significant game fish populations; however, they do afford spawning areas for northern pike, walleye, sauger, and catfish. These streams generally contain good populations of non-game forage fishes but have inadequate flows for sustaining game fish. Water quality appears to be poor but has not been documented (Needham, 1974).

Some ponds and small creeks, i.e., Wolf Creek, contain brook and/or rainbow trout. Some of the ponds in this basin contain good populations of bass and northern pike (Konizeski, 1970).

Actually, little is known about the biological conditions in this basin. The biota of the Missouri River from Fort Peck Dam to the mouth of the Milk River should be determined primarily by discharges from Fort Peck Reservoir. The Poplar River and the smaller streams probably suffer from silt originating from poor agricultural practices, but this has not been documented. High salt concentrations affect some of the lakes on the Medicine Lake National Wildlife Refuge and probably numerous small ponds in the basin.

A stable stream flow, water temperature, and water chemistry are important for the aquatic furbearers. On the Lower Missouri River, Poplar River, and Big Muddy Creek, beaver and muskrat den almost exclusively in the bank, as do mink occasionally. These dens are sometimes destroyed by

spring floods, but these losses have never been documented. The food supply is the critical item, especially for beaver, which depend heavily on willow growing on the flood plain. A fairly stable water flow is necessary to maintain this food supply. High turbidity probably has no effect, although changes in water temperature and/or water chemistry could have an important effect as it influenced shoreline vegetation (Trueblood, 1974).

V. MONTANA WATER POLLUTION CONTROL PROGRAM

Water quality management planning is part of a broad, comprehensive water pollution control program adm nistered by the Water Quality Bureau of the Environmental Sciences Division. This program is described in the program plan of the Water Quality Bureau (1974). Important elements of the state program are:

1. State and federal waste discharge permit program.

2. Water quality standards.

3. Facilities construction grants, plan review, operation and maintenance inspections, training and licensing of operators.

4. Statewide monitoring and surveillance program.

5. Public participation.

6. Enforcement.

STATE AND FEDERAL WASTE DISCHARGE PERMIT PROGRAM

The 1955 Montana state law established a waste discharge permit program. A revision of this law in 1967 required a permit for all discharges. Regulations and a formal state permit program were established in 1968 for the discharge of sanitary sewage and municipal wastes to waters of the state. In 1972, a waste discharge permit regulation for confined livestock feeding was adopted by the Board of Health and Environmental Sciences. All operations feeding livestock for marketing purposes within any confined area or enclosure not normally used for raising crops or for pasture, which at any time discharges drainage water to a state water, is required to have a permit. Existing operations were required to have a permit before June 24, 1974. All new or expanding operations are required to have a permit.

The Federal Water Pollution Control Act Amendments of 1972 established a national permit system. Industrial, municipal, and other point source discharges will be required to obtain permits to discharge pollutants into navigable

waters or their tributaries. The EPA (U. S. Environmental Protection Agency) has given authority to allow states to administer the permit program provided the states conform to certain guidelines. On June 11, 1974, Montana assumed most of the federal permit program.

Waste discharge permits are an effective tool for regulating discharge of potentially harmful effluents into Montana lakes and streams. Treatment works will be required to meet specific effluent standards. In most instances, the discharger will be responsible for certain monitoring information; for example, sampling and analysis of the water at specified intervals. In instances where effluent being discharged does not meet state standards, the permit is issued on a "compliance" basis with stipulations as to what corrections will be made and when.

The act also provides that the permit program will achieve, not later than July 1, 1977, effluent limitations for point sources, other than publicly owned treatment works, which shall require the application of best practicable control technology. For publicly owned treatment works, secondary treatment of wastes or any more stringent limitation necessary to meet water quality standards will be required by July 1, 1977. The act further specifies that by July 1, 1983, effluent limitations for point sources, other than publicly owned treatment works, shall require application of the best available technology. Publicly owned treatment works shall achieve best practicable treatment by July 1, 1983.

These steps will result in progress toward a national goal of eliminating the discharge of all pollutants by 1985.

WATER QUALITY STANDARDS

Water pollution control was started officially in Montana in 1907 with the passage of legislation designed to protect domestic water supplies. A law passed in 1955 was more comprehensive. It dealt with the control and protection of water for additional uses--recreation, agriculture, and industry. The law also established a Water Pollution Control Council and charged it with the tasks of classifying all streams in the state according to their most beneficial uses and establishing water quality criteria for the streams. It also involved upgrading the treatment of wastes going into the streams. Montana, thus, became one of the first states to have enforceable stream classifications.

In 1965, the United States Congress passed the Federal Water Quality Act, which required that all states classify and establish water quality criteria for their interstate streams by July 1, 1967. This resulted in Montana revising its standards for both interstate and intrastate waters and required a higher degree of stream quality than before. Secondary treatment or the equivalent was required of municipal and industrial discharges. Primary treatment or equivalent was required before passage of the act.

In October, 1972, the Federal Water Pollution Control Act Amendments were passed by Congress expanding the authority of the Environmental Protection Agency. Uniform water quality standards and enforcement procedures throughout the United States is the objective. For example, industrial waste dischargers throughout the nation manufacturing the same product will have uniform discharge requirements, based on the amount of product produced. Again, Montana was required to revise its water quality standards. The Department of Health and Environmental Sciences adopted revised standards on July 1, 1973. The new standards became effective in November, 1973.

Other point sources covered by these amendments include certain animal confinement facilities and irrigation activities. The owner or operator of any animal confinement facility which holds, or during the previous 12 months held, for a total of 30 days or more 1,000 or more animal units must make application for a waste discharge permit. The owner or operator of a drainage system serving 3,000 or more irrigated acres must likewise make application for a waste discharge permit.

The Montana Pollutant Discharge Elimination System rule extends the permit requirement to cover any animal confinement facility which could discharge pollutants to state waters.

Montana water quality standards serve as a functional tool in protecting water quality; however, there are a number of laws, statutes and regulations which complement the water quality standards and significantly assist in protecting water quality.

STATEWIDE MONITORING AND SURVEILLANCE PROGRAM

Prior to 1972, Montana had done little monitoring due to lack of funds. With increased appropriations provided by the 1971 legislature and the federal government, the state greatly increased its efforts. Staff were added and laboratory equipment purchased. The present state monitoring program includes periodic compliance monitoring of municipal and industrial wastes, long-term baseline monitoring of streams, and a statewide program for determining the general quality of all significant surface waters.

The statewide inventory of water quality will identify areas with water quality problems and will provide basic data for water quality management and planning programs. Included in the monitoring is a statewide assessment of the trophic (pollution level) status of Montana's lakes, reservoirs, and ponds. This program is coordinated with the EPA National Eutrophication Survey.

FACILITIES CONSTRUCTION, OPERATION AND MAINTENANCE

A minimum requirement of primary treatment for all domestic sewage was first adopted by the Montana Board of Health in 1952. All of Montana's communities have met this requirement, and many of the communities are upgrading their facilities to secondary treatment or are in the process of constructing or planning secondary systems. Since 1956, there has been a federal grant program to assist municipalities in the construction of sewage treatment facilities, including outfall and interceptor sewers. In 1971, the Montana state legislature appropriated $4,000,000 to aid municipalities in construction of these same facilities. The 1973 legislature appropriated $1,600,000 to reimburse municipalities that had proceeded with construction since July 1, 1966, without waiting for state grants. With passage of the Federal Water Pollution Control Act Amendments of 1972, 75 percent of eligible project costs are federally financed. Due to a shortage of federal grant funds, a priority system for fund allocation must be used. The state, under EPA guidance, established priorities for waste treatment projects.

An important part of municipal sewage treatment is proper operation and maintenance of facilities after construction is completed. In an effort to improve operation and maintenance, the state has conducted an operators' school each year. During recent years, this school has had about 100 operators attending. In 1971, a grant was obtained from the federal government for employing two training instructors to establish training programs throughout the state in addition to the annual school.

An operators certification program was established in 1968 following enactment of a law requiring certification of those in responsible charge of a sewage treatment or industrial waste treatment system.

PUBLIC PARTICIPATION

Public participation in water pollution control is an increasingly important aspect of the state program. Public hearings are held concerning proposed regulations, water quality management plans, and waste discharge permit applications. The state also has an environmental impact statement requirement. These statements are presented to the public for comment, and hearings are conducted on highly controversial issues.

The public is also kept informed by means of a Water Pollution Control Advisory Council, which has been established by law to assist the Water Quality Bureau in preparation of rules and regulations and in dissemination of information to interested groups. Similarly, public meetings are attended on request, and a bi-monthly newsletter is published by the Water Quality Bureau.

ENFORCEMENT

The 1955 Montana state law provided enforcement procedures. These laws were revised in 1971 to provide better enforcement, and an attorney was added to the staff of the department to aid in enforcement. The state permit system provides a primary means for enforcement. Violators of permit conditions or discharges without a permit can lead to enforcement.

VI. WATER POLLUTION SOURCES

Water Pollution in the Lower Missouri River basin is caused by several factors, including municipal discharges, runoff from mismanaged and erodible soils, and agricultural wastewaters. Characteristics of significant municipal discharges are summarized in Table 6. Some lagoons have high sulfate ion concentrations, but no known odors or other problems have been created by this condition.

MUNICIPAL DISCHARGES AND OTHER POSSIBLE WATER POLLUTION SOURCES

Several communities in the study basin discharge sewage lagoon effluent into adjacent streams (Figure 1 and Plate I), but most of the municipal sewage facilities are designed for complete retention. In additon, there is a proposal by the Saskatchewan Power Corporation for a generating station to be located in Canada on the east fork of the Poplar River.

Bainville

By means of eight, 10, and 12-inch sewer mains, sewage is carried to the east edge of town. From here, a 12-inch outfall line carries the sewage to a lift station. The estimated load of untreated sewage has a population equivalent of 250, and this system, a non-discharging stabilization lagoon (Township 28 North, Range 58 East, Section 35 B), is presently in compliance with minimum treatment requirements.

Brockton

By means of an eight-inch sewer main, sewage is carried to a collection point at the east edge of town. An eight-inch outfall line then carries the sewage to a 4.3-acre, two-cell waste stabilization lagoon (Township 28 North, Range 53 East, Section 28 B). Estimated load of untreated sewage has a population equivalent of 400. More work is needed to determine if this system is in compliance with minimum treatment requirements.

Circle

By means of six, eight, and 10-inch sewer mains, sewage is carried from the community of Circle to a collection point at the east edge of town. A lift station then forces the sewage through an eight-inch line to the 20-acre wastewater stabilization lagoon (Township 19 North, Range 49 East, Section 11 D). Treated sewage has a

TABLE 6. CHARACTERISTICS OF MUNICIPAL DISCHARGES

Municipality and Location[1]	Treatment Type	Receiving Water	Discharge Permit No.	Discharge Type	Date Sampled	Discharge Characteristics[2] Units are mg/l unless otherwise shown.			
Bainville 28N 58E 35B	Lagoon	Shotgun Creek	MT 0021971	No discharge	10/8/74	Ca	256	SO_4	1845
						Mg	205	NO_3	0.09
						Na	810	PO_4	4.5
						HCO_3	244	pH	8.3
						Cl	775	[4] Spec. Cond.	5410.0
						[3] TR Cu	0.03	B	1.3
						TR Zn	0.02	TSS	112
						TR As	0.006	TR Fe	0.25
						TR Mn	0.06	TR Cd	<0.001
Brockton 28N 53E 28B	Lagoon	Missouri River	MT 0023001	Continuous	10/7/74	Ca	46	NO_3	0.60
						Mg	36	PO_4	14
						Na	290	B	0.46
						HCO_3	671	TR Cu	0.01
						Cl	0.2	TR Zn	0.02
						Spec. Cond.	1606.0	TR As	0.016
						TSS	210	TR Fe	0.26
						Fecal coliform	47,000	TR Mn	0.04
								TR Cd	<0.001
Circle 19N 49E 11D	Lagoon	Redwater River	MT 0020796	Intermittent	10/8/74	Ca	9.6	PO_4	64
						Mg	9.2	B	2.0
						Na	860	TR Cu	0.02
						HCO_3	2135	TR Mn	0.07
						Cl	12.5	TR As	0.006
						SO_4	88	TR Fe	0.26
						NO_3	4.4	TR Zn	<0.01
						pH	8.0	TR Cd	<0.001
						Spec. Cond.	3610.0	TSS	148

(1) See Appendix C.
(2) From data collected by the Water Quality Bureau during Lower Missouri River basin study.
(3) TR - Total Recoverable.
(4) Specific conductance - μmho at 25° C.

Municipality and Location[1]	Treatment Type	Receiving Water	Discharge Permit No.	Discharge Type	Date Sampled	Discharge characteristics[2] Units are mg/l unless otherwise shown.			
Culbertson 28N 56E 32B	Lagoon	Missouri River	MT 0021407	Inter-mittent	10/8/74	Ca	49	[3]TR Cu	0.01
						Mg	39	TR Zn	0.08
						Na	180	TR As	0.005
						HCO_3	351	TR Fe	0.18
						Cl	49	TR Mn	0.04
						SO_4	350	TR Cd	<0.001
						NO_3	0.10	TSS	18
						PO_4	29	pH	7.5
						B	0.44	[4]Spec. Cond.	1240.0
Froid 30N 55E 25A	Lagoon	Sheep Creek	MT 0020192	No dis-charge	10/8/74	Ca	121	TR Cu	0.02
						Mg	162	TR Zn	0.02
						Na	840	TR As	0.007
						HCO_3	817	TR Fe	0.21
						Cl	10.8	TR Mn	0.19
						SO_4	1400	TR Cd	<0.001
						NO_3	0.25	TSS	110
						PO_4	24	pH	8.20
						B	0.8	Spec. Cond.	4800.0
Medicine Lake 32N 56E 25C	Lagoon	Muddy Creek	MT 0020869	Inter-mittent	10/8/74	Ca	135	TR Cu	0.04
						Mg	95	TR Zn	0.02
						Na	680	TR As	0.004
						HCO_3	780	TR Fe	0.12
						Cl	15.2	TR Mn	0.62
						SO_4	900	TR Cd	<0.001
						NO_3	0.10	TSS	102
						PO_4	21	pH	8.20
						B	1.1	Spec. Cond.	3980.0

(1) See Appendix C.
(2) From data collected by the Water Quality Bureau during Lower Missouri River basin study.
(3) TR - Total Recoverable
(4) Specific Conductance -γmho at 25° C.

Municipality and Location[1]	Treatment Type	Receiving Water	Discharge Permit No.	Discharge Type	Date Sampled	Discharge characteristics[2] Units are mg/l unless otherwise shown.			
Plentywood 35N 55E 19D	Lagoon	Big Muddy Creek	MT 0022152	Inter-mittent	10/8/74	Ca	69	[3] TR Cu	0.04
						Mg	157	TR Zn	<0.01
						Na	635	TR As	0.003
						HCO_3	1032	TR Fe	0.80
						CO_3	39	TR Mn	0.03
						Cl	93	TR Cd	<0.001
						SO_4	950	TSS	22
						NO_3	0.05	pH	8.80
						PO_4	14	[4] Spec. Cond.	4080.0
						B	0.92		
Poplar 27N 50E 12D	Lagoon	Missouri River	MT 0021695	Continuous	10-7-74	Ca	64	TR Cu	0.01
						Mg	64	TR Zn	<0.01
						Na	440	TR As	0.008
						HCO_3	805	TR Fe	0.12
						Cl	1.8	TR Mn	0.29
						SO_4	560	TR Cd	<0.001
						NO_3	0.90	TSS	78
						PO_4	24	pH	7.80
						B	0.88	Spec. Cond.	2550.0
Scobey 35N 48E 16D	Lagoon	Poplar River	MT 0020206	Inter-mittent	10-7-74	Ca	20	TR Cu	0.05
						Mg	50	TR Zn	0.01
						Na	430	TR As	0.006
						HCO_3	579	TR Fe	0.30
						CO_3	108	TR Fe	0.30
						Cl	8.5	TR Mn	0.03
						SO_4	450	TR Cd	<0.001
						NO_3	0.10	TSS	112
						PO_4	16	pH	9.4
						B	1.5	Spec. Cond.	2340.0

(1) See Appendix C.
(2) From data collected by the Water Quality Bureau during Lower Missouri River basin study.
(3) TR - Total Recoverable.
(4) Specific Conductance - μmho at 25° C.

Municipality and Location[1]	Treatment Type	Receiving Water	Discharge Permit No.	Discharge Type	Date Sampled	Discharge characteristics[2] Units are mg/l unless otherwise shown.			
Westby 36N 58E 24A	Lagoon	No discharge	MT 0022101	No discharge	10/8/74	Ca	57	[3] TR Cu	0.01
						Mg	63	TR Zn	0.01
						Na	285	TR As	0.012
						HCO_3	278	TR Fe	0.26
						CO_3	30	TR Mn	0.1[illegible]
						Cl	52	TR Cd	0.001
						SO_4	620	TSS	80
						NO_3	0.11	pH	8.7
						PO_4	10	[4] Spec. Cond.	1930.0
						B	0.42		
Wolf Point 27N 47E 21B	Lagoon	Missouri River	MT 0020532	Intermittent	10/7/74	Ca	58	TR Cu	0.02
						Mg	61	TR Zn	0.05
						Na	700	TR As	0.006
						HCO_3	683	TR Fe	0.32
						CO_3	48	TR Mn	0.16
						Cl	35	TR Cd	0.001
						SO_4	692	TSS	116
						NO_3	0.35	pH	8.7[illegible]
						PO_4	11	Spec. Cond.	3930.0
						B	0.7		

(1) See Appendix C.
(2) From data collected by the Water Quality Bureau during Lower Missouri River basin study.
(3) TR - Total Recoverable.
(4) Specific Conductance - μmho at 25° C.

population equivalent of near zero. The storm sewer and sanitary sewer are separate systems. It is felt more work is needed to determine compliance with state minimum treatment requirements.

Culbertson

By means of an eight-inch sewer main, sewage is carried to a collection point near the south edge of town. An eight-inch outfall line carries the sewage to a lift station from where the sewage is forced through an eight-inch line to a 14.4-acre wastewater stabilization lagoon (Township 28 North, Range 56 East, Section 32 B). Estimated load of untreated sewage has a population equivalent of 800. The system is in compliance with state minimum treatment requirements. There are plans to construct a dike around approximately 20 additional acres to form an additional cell that will be used for irrigation and evaporation of the lagoon discharge.

Flaxville

The community of Flaxville is currently installing a sewage collection system and constructing a wastewater stabilization lagoon (Township 35 North, Range 50 East, Section 9). Designed for complete retention, the lagoon will be a two-cell, four-acre facility, adequate for a population of 200.

Frazer

By means of an eight-inch collection pipe, sewage is carried to the west edge of town. An eight-inch outfall line then carries the sewage to a 3.3-acre waste stabilization lagoon (Township 27 North, Range 44 East, Section 33 A). The estimated load of untreated sewage in this system has a population equivalent of 300, and the system, with no discharge, is presently in compliance with minimum treatment requirements.

Froid

By means of an eight-inch sewer main, sewage is carried to a collection point on the west side of town. A lift station then pumps the sewage through an eight-inch line to the 6.1-acre waste stabilization lagoon (Township 30 North, Range 55 East, Section 25 A). Estimated load of untreated sewage has a population equivalent of 300, and the system, with no discharge, is presently in compliance with minimum treatment requirements.

Medicine Lake

By means of six and eight-inch sewer mains, sewage is carried to the west edge of town. Two 150 gallon per minute pumps then pump the sewage through a four-inch forcemain.

to a 4.5-acre, two-cell lagoon (Township 32 North, Range 56 East, Section 25 C). Storm sewers are separate from the sanitary sewer. Estimated load of the untreated sanitary sewage has a population equivalent of 390, and the system, with no discharge, is presently in compliance with minimum treatment requirements.

Opheim

By means of an eight-inch collection pipe, sewage is carried to a point near the northwest edge of town. An eight-inch outfall line then carries the sewage to a six-acre, two-cell waste stabilization lagoon (Township 36 North, Range 40 East, Section 24 A). The estimated load of untreated sewage in this system has a population equivalent of 300. The system, with no discharge, is in compliance with minimum treatment requirements.

Plentywood

By means of an eight-inch sewer main and a lift station on the east edge of town, sewage is carried to the west edge of town. A 12-inch outfall line then carries the sewage to the 40.9-acre, two-cell waste stabilization lagoon (Township 35 North, Range 55 East, Section 19 D). Estimated load of untreated sewage has a population equivalent of 2,400. More work is needed to determine if the system is presently in compliance with minimum treatment requirements.

Poplar

By means of six, eight, ten, 12, and 18-inch sewer mains, sewage is carried to the south edge of town. An 18-inch outfall line reduced to an eight-inch line carries the sewage to a 20.1-acre, two-cell waste stabilization lagoon (Township 27 North, Range 50 East, Section 12 D). About 35 city blocks have storm sewer drainage to the sanitary sewer system. Estimated load of untreated sewage has a population equivalent of 1,350, and the system is not in compliance with minimum treatment requirements. Improved facilities are being planned.

Reserve

Few residents now inhabit this community on the Fort Peck Indian Reservation. Private septic tanks are used for sewage disposal, and as the soil is unsatisfactory for sewage drainfields, effluent from the septic tanks is collected and discharged to several large tanks, which then discharge to Muddy Creek. A more detailed study should be done to determine the most feasible way to eliminate this discharge to the creek.

Richey

By means of six, eight, and ten-inch sewer mains, sewage is carried to a collection point near the northwest edge of town. A ten-inch outfall line then carries the sewage to a two-cell, 5.6-acre stabilization lagoon (Township 22 North, Range 52 East, Section 19 D). Storm sewers and sanitary sewers are separate systems, and estimated load of untreated sanitary sewage in this system has a population equivalent of 380. Work is needed to determine compliance status of the system. There are plans to construct an additional cell that will be used for irrigation and evaporation of the lagoon effluent.

Scobey

By means of an eight-inch sewer main, sewage from Scobey is carried to the west edge of town. A 12-inch outfall lines carries the sewage to a 31.1-acre, two-cell waste stabilization pond (Township 35 North, Range 48 East, Section 16 D). Estimated load of untreated sewage has a population equivalent of 2,975, and further work is needed to determine the compliance status of this system.

Westby

By means of an eight-inch sewer main, sewage from Westby is carried to the southwest edge of town to a three-cell stabilization pond. This sewer system, constructed in 1973, was designed for total retention and, as yet, has not had sufficient volume to utilize the third cell.

Wolf Point

By means of eight, 12, and 20-inch sewer mains, sewage is carried to the southeast edge of town. A lift station forces the sewage to the 48-acre, single-cell stabilization lagoon (Township 27 North, Range 47 East, Section 21 B). Approximately ten city blocks of storm sewage enters the sanitary sewer. Estimated load of untreated sanitary sewage has a population equivalent of 3,200, and at the time of this report, it is felt further work was needed to determine compliance status.

Saskatchewan Power Corporation Generating Plant

Although located outside the United States and the study area, the proposed power generating plant, to be located in Canada, would affect the east fork of the Poplar River and, thus, should be discussed. The proposed project, approximately six miles southeast of Coronack, will occupy

3,200 acres in Townships 1, 2, and 3 of Ranges 26, 27, and 28(1). During a 30-year life span, the 1,200 megawatt generating station, consuming 7,000,000 tons of lignite coal per year, will consume between 180 and 200 million tons of coal. It will require 11,000 acre-feet of water per year and 1,200 acre-feet of surface water for cooling purposes (Saskatchewan Power Corporation, 1974). As the flow of the Poplar River, east fork, is not sufficient to sustain the operation of this project, supplemental water from either Thompson Reservoir, Buffalo Pound Lake, Diefenbaker Lake, or the South Saskatchewan River Qu Appelle Valley Dam will be utilized. The above project is proposed with consideration to several commitments and assumptions (Saskatchewan Power Corporation, 1974), a few of which are:

1. That adversely affected, existing water users will be accommodated or compensated.

2. The Saskatchewan Power Corporation will incorporate facilities to meet the air and water pollution control requirements of the Saskatchewan Department of the Environment in the design and construction of this power plant.

In a review of the Poplar River generating station outline, the Saskatchewan Department of the Environment and Shultz International Limited, a consulting firm, have suggested many unanswered questions (Saskatchewan Power Corporation, 1974), a few of which are:

1. Will the East Poplar River be rendered turbid?

2. What are the seasonal sensitivities regarding downstream effects, and what are the options in construction?

3. What are the effects of forced reduction in downstream use for people and other life forms? Would some downstream flood control benefits be possible?

4. Have all legalistic problems associated with the international boundary been reviewed? Have the international commitments with respect to the East Poplar River been given consideration?

5. Have sufficient calculations been made of downstream turbidity, temperature, quality and discharge regimes to predict both positive and negative effects for all anticipated seasonal parameters?

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(1) Canadian geological survey designations.

6. Has an estimate been made of the quantity and quality of the water to be expected from the mined area? Does this include an analysis for acid mine drainage?

7. Will possible interference with aquifers affect stream discharge?

Burlington Northern Railroad

Burlington Northern is planning a synthetic fuels plant to be located northwest of Circle. This plant will daily produce 1,000 to 3,000 tons of ammonia, 2,500 to 5,000 tons of methyl fuel, and 10,000 to 30,000 barrels of synthetic diesel fuel. In the process, 12,000 to 32,000 acre-feet of water and 5 to 13 million tons of lignite would be consumed annually (Montana Energy Advisory Council, 1974).

Other pollution sources have been identified in this basin, but the investigation of these problems was curtailed due to the shortage of funds and manpower.

AGRICULTURAL DISCHARGES

A variety of agricultural wastes are present in the Lower Missouri River basin, including irrigation return flows, animal wastes, runoff from range and cultivated lands, and from land treated with pesticides and fertilizers. There are numerous potential water quality problems due to these agricultural practices, but more work is needed in this basin to inventory specific problems and the magnitude of these problems. Agricultural pollution is transient in both time and space and is complex due to the variability of agricultural practices. The effect of agricultural wastes on water quality generally is difficult to determine without long-term studies. Gross agricultural pollution problems in the basin are not apparent; however, the summation effect of the many small agricultural abuses is felt to be significant. Future water quality monitoring and additional basin investigations will assist in quantification of agriculture's role in water quality. Several agricultural waste discharge permit applications for the basin have been received. Only one of these, Nash Brothers, Inc., is listed as having a discharge. This discharge will, in the near future, be eliminated.

Fladager Feedlot

Mr. Milton Fladager, since 1969, has operated an animal confinement facility located in the NE 1/4, NE 1/4, Section 10, Township 35 North, Range 45 East in Daniels County, approximately 2.5 miles northeast of Peerless, Montana. This animal confinement facility encompasses approximately two acres and has a capacity for approximately 700 beef cattle. Surface runoff and livestock wastes from the feeding area and an additional four-acre drainage area is contained in waste control facilities designed to store all runoff which can be expected from this drainage area following a 10-year, 24-hour rainfall event. Waste material which accumulates in the retention pond and on the feedlot surface is removed periodically and disposed of on 450 acres of adjacent agricultural land. Mr. Fladager was issued, on June 11, 1973, permit No. F-9-B to construct and operate a livestock waste control facility.

Casterline Enterprises

Mr. W. R. Casterline currently operates an animal confinement facility located in the NE 1/4, SW 1/4, Section 27, Township 28 North, Range 56 East in Roosevelt County, approximately two miles east of Culbertson, Montana. This animal confinement facility consists of an open lot

beef feeding operation and a total confinement swine operation. The open lot operation encompasses approximately 15 acres and has capacity for 300 beef cattle. Surface runoff and livestock waste from this animal confinement facility is contained through the natural topography of the area and should, therefore, not have a discharge to state waters. Based on an on-site evaluation, Permit No. F-25-B for livestock waste control facilities was issued on September 14, 1973. The swine operation consists of a total confinement building having capacity for approximately 2,000 head. Waste material from the animals held in confinement drops through a slatted floor into a liquid manure pit. This waste material is then periodically removed with a vacuum truck and spread on adjacent cropland. Approximately 800 acres of land is available for waste disposal. Permit No. F-4-H was issued for this facility on May 7, 1973.

Walikonis Farms

Mr. James L. Walikonis currently maintains a total confinement swine operation having a maximum design capacity for approximately 500 head. The swine operation is located in the SE 1/4, NE 1/4, Section 25, Township 32 North, Range 53 East in Roosevelt County, approximately 22 miles west of Medicine Lake, Montana. Waste material produced by the animals held in confinement drops through slatted floors into a manure pit located beneath the building. This waste material is periodically removed and disposed of on approximately 1,000 acres of agricultural land. Waste discharge permit No. MT-0029008 was issued for this animal confinement facility on July 3, 1974.

Forrest H. Brown

Mr. Forrest H. Brown currently operates a confined swine facility having a maximum capacity for approximately 600 head. This facility is located in the NE 1/4, NE 1/4, Section 33, Township 30 North, Range 51 East in Roosevelt County, approximately 20 miles northeast of Poplar, Montana. This operation consists of a total confinement farrowing building and an open lot finishing unit. The waste material produced within the building, as well as surface runoff from the open lot portion, is discharged to a retention pond. The retention pond has been lined with bentonite to restrict seepage. The waste material which accumulates in the pond will periodically be removed by pumping and disposed of on adjacent agricultural land. Waste discharge permit No. MT-0029026 was issued to Mr. Brown on October 30, 1974.

Richardson Swine Operation

Mr. Robert Richardson currently operates a confined swine facility having capacity for approximately 760 animals. This facility is located in the SE 1/4, Section 2, Township 34 North, Range 55 East in Sheridan County, approximately two and one-fourth miles northwest of Antelope, Montana. The waste material which is produced by the animals drops through slatted floors into a liquid manure pit beneath the buildings. These pits provide storage for a minimum of 180 days' waste productions, and the waste material is periodically removed and spread on approximately 600 acres of agricultural land.

Hilyard Farms

Mr. Harry D. Hilyard currently operates a total confinement swine facility having capacity for approximately 900 animals. This facility is located in the NE 1/4, Section 29, Township 35 North, Range 55 East in Sheridan County, approximately 1.5 miles southeast of Plentywood, Montana. Waste material generated by the livestock held in confinement is contained is a 200,000 gallon holding tank. This waste material is periodically removed and transported to agricultural land for final disposal. Waste discharge permit No. F-5-H was issued to this facility on May 7, 1973.

Thompson Hog Farm

Mr. Eugene Thompson, since 1970, has operated a confined swine facility having a capacity for approximately 600 head. This facility is located in the NE 1/4, SW 1/4, Section 19, Township 33 North, Range 53 East in Sheridan County, approximately 20 miles west of Reserve, Montana. The operation consists of a total confinement farrowing through finishing facility. Waste material which is produced drops through the slatted floors and is contained in liquid manure pits located beneath each building. These pits provide storage capacity for at least 120 days' waste production. The waste material is periodically removed from these tanks and disposed of on approximately 440 acres of adjacent agricultural land. Waste discharge permit No. MT-0029015 was issued to this animal confinement facility on July 26, 1974.

McCabe Farms, Inc.

McCabe Farms, Inc. currently operates an animal confinement facility located in the NE 1/4, Section 19, Township 31 North, Range 56 East in Sheridan County, approximately four miles east of Homestead, Montana. This facility

encompasses approximately 20 acres and has capacity for 1,200 beef feeder cattle. Any surface runoff from this facility will be discharged to adjacent agricultural land with little possibility of ever reaching state waters. The waste material which accumulates on the feedlot surface is removed at least once per year prior to the use of the facility and disposed of on approximately 5,000 acres of agricultural land. Permit No. MT-0022756 will be issued to this facility on December 30, 1974.

Wolf Point Feeders, Inc.

Wolf Point Feeders, Inc. currently operates an animal confinement facility located in the SW 1/4, NE 1/4, Section 23, Township 27 North, Range 46 East in Roosevelt County, approximately four miles west of Wolf Point, Montana. This facility encompasses approximately 17 acres and has capacity for 3,000 beef feeder cattle. Surface runoff and livestock waste from the confinement area is discharged into two settling basins with an overflow to a common retention pond. These facilities provide adequate storage to retain all runoff from the drainage area which could be expected following a 10-year, 24-hour rainfall event. Waste material which accumulates on the feedlot surface, as well as that which accumulates in the retention pond, is periodically removed and disposed of by numerous farmers in the area utilizing the waste material as fertilizer on their croplands. Waste discharge permit No. MT-0022195 will be issued for this facility on December 30, 1974.

Nash Brothers, Inc.

Nash Brothers, Inc. currently operates an animal confinement facility located in the SW 1/4, Section 11, Township 35 North, Range 48 East in Daniels County, approximately one-half mile northeast of Scobey, Montana. The facility encompasses approximately 15 acres and has capacity for 2,000 beef feeder cattle. At the present time, surface runoff from this facility is discharged through unnamed drainages to the Poplar River. An implementation schedule has been proposed for this facility which calls for the submittal of plans for a waste control facility on or before April 30, 1975, and for the completion of such facilities and compliance with effluent limitations on or before July 1, 1975. Permit No. MT-0022233 will be issued for this facility on December 30, 1974.

MINING AND OIL EXPLORATION ACTIVITY

Although some coal mining has been done in the past, no known mining activity is presently occurring in this basin.

Mining, in general, has not been a water pollution problem. Oil exploration is being increased south of Westby, and there are presently a number of producing oil wells in this area. Local ranchers have great concern, and there is evidence that suggests oil extraction processes may, in the past, have contaminated groundwater supplies. Various agencies are presently conducting studies in cooperation with the Water Quality Bureau to determine the magnitude of the problem and are evaluating means to prevent future groundwater contamination.

Several strippable subbituminuous and lignite coal fields exist in this basin (Table 7).

TABLE 7. STRIPPABLE SUBBITUMINUOUS AND LIGNITE COAL FIELDS

Name of Field	Estimated Reserve Million Tons	Acreage
Lane	561	44,582
Carroll	345	29,780
Redwater River	642	24,181
Weldon-Timber Creek	724	25,565
Fort Kipp	331	14,500
Lanark	100	3,531
Medicine Lake	58	3,740
Reserve	246	18,231
Coal Ridge	150	19,200

Development of these coal reserves will depend on future energy needs and probably on the available water for such things as cooling purposes.

NON-POINT SOURCES

Some potential non-point pollution sources have been discussed under agricultural wastes and fertilizers. All can create non-point pollution sources. A variety of other non-point pollution sources exist, including erosion and deposition of sediment on non-agricultural lands, construction projects, toxic substances, and salinity from saline soils in the area. Identifying non-point sources of pollution is difficult and would require considerable effort. Some saline seep waters were collected and analyzed as part of a saline seep inventory.

There are numerous naturally alkali or saline soils due to poor drainage. Saline seep areas, for purposes of this report, are considered to be those recently developed saline soils that are related to cropping practices. Such soils restrict or completely stop agricultural productivity. Saline seeps are not only detrimental to crops but cause losses to wildlife populations, livestock, aquatic and underground water supplies. The mechanism creating saline seeps is due to infiltration and precipitation into salt-laden soils, solution of salts into groundwater, and the subsequent reappearance of these salts at the ground surface. The crop-fallow system greatly aggravates this problem (Bahls and Miller, 1973). Characteristic saline seep waters tend to be high in conductivity, bicarbonates, sodium, sulfates, total dissolved solids, and metals (Table 8).

Saline seep is an extensive problem in the Lower Missouri River basin with an estimated 29,500 acres of non-irrigated cropland affected. Table 9 indicates by county the increase in saline seep losses from 1969 to 1973.

A shallow impervious shale overlain by salt-bearing strata, plus the summer fallow crop system, has resulted in loss of productive acreage and in streams becoming more saline. Streams such as Sheep Creek, the Poplar River, and Big Muddy Creek cannot be used for irrigation during the summer months because of the high total dissolved solids (SCS, 1975).

TABLE 8. SUMMARY OF SALINE SEEP WATER QUALITY[1]

Sample Description and Location[2]	Ca	Mg	Na	Fe	Mn	Pb	Cu	Zn	HCO_3	CO_3	SO_4	Cl	NO_3	Spec. Cond.[3]	Se	Mo	Cr	V	As
Shore Bird Flats 4 miles northwest of Scobey 36N 48E 28BDD	13		4,700						2,013	2,172	4,163	300	66	10,000					
Bedwell Farm Gully 10 miles south of Arch 34N 52E 36ACC	58	130	105	.24	.15	<.01	.01	.03	329	0	551	20	4.4		<.001	<.1	.01	.1	.001
Old Pond Bottom three miles northeast of Comertown 36N 58E 02BBD	96	93	450	61	14	<.01	.17	.33	0	0	1,038	25	62	1,795	.001	<.1	.01	.1	.001
Tomato Can Creek 17 miles north of Nashua 30N 42E 14DDD	140	246							354	60	3,620	215	4.4	7,400					
Brush Lake four miles east of Dagmar 33N 58E 28DCC	449	0	388						464	174	0	60	3.4	6,100					
Second Hay Creek .6 miles northeast Rt. 6 25N 58E 26DDA	48	361	2,400	.33	.65	<.01	.03	.02	342	60	6,100	30	6.6	9,020	<.001	<.1	<.01	<.1	.010
Shotgun Creek one mile northwest of Bainville before Rail Tracts 28N 58E 27CDD	28	52	281						710	0	390	10	2.5	1,485					

(1) Sampled August, 1974.
(2) See Appendix C.
(3) Specific conductance - μmho at 25° C.
(4) NO_3 + NO_3 expressed as NO_3

TABLE 9. ACRES OF SALINE SEEP ON CROPLAND[1]

County	1969	1971	1973	% Increase
Daniels	500	5,800	5,800	1,060
Roosevelt	12,000	12,000	12,500	4.1
Sheridan	10,000	10,000	10,000	0
Richland	1,500	1,500	3,000	100
McCone	800	800	1,200	50

(1) SCS Data.

In Daniels and Sheridan counties, there are many naturally saline pothole lakes. Analysis of Brush Lake indicates that there has been no change in the water quality since 1933 (Table 10). Several farmers have reported wells going bad, and the effect of saline water on wells is being studied by the Agricultural Research Station in Sidney, Montana. A solution to the saline seep problem is being worked on by the local soil conservation agent, who has seeded various grasses, but detailed information is not yet available. The Water Quality Bureau is also doing water analyses, assembling information to determine the severity of the problem, and is investigating the quality of water involved.

TABLE 10. ANALYSIS OF BRUSH LAKE NORTHEAST OF TWO MEDICINE [1]
(Data for 1933, 1944, 1966)

Constituent	11/13/33	6/17/44	11/30/66
Calcium	11		0.0
Magnesium	318		286
Sodium	1388		
Iron			0.07
Bicarbonate	1559		
Carbonate	258		336
Sulphate	2842	2845	2870
Chloride	71	207	95
Nitrates			0.0
Fluoride			1.2
Total Dissolved Solids	6145	6070	6000

(1) Water Quality Bureau county files.

In other drainage basins, irrigation return flows are non-point discharge problems; however, in the Lower Missouri River basin, most irrigation systems involve only a few acres. SCS personnel have indicated that there are some months when these waters are unsuitable for irrigation due to total dissolved solids. Further studies would be required to completely assess the significance of irrigation return flows in the Lower Missouri River basin.

The most significant non-point discharge problem in the basin is the saline seep problem. Table 11 indicates a non-point source problem ranking and shows the benefits from continued work on the problem.

TABLE 11. NON-POINT SOURCE PROBLEM RANKING AND BENEFITS FROM CONTINUED WORK ON THE PROBLEM

Problem	Benefits
1. Saline seep	A. Improved water quality
	B. Increased crop production
2. Irrigation return flow - poor quality	A. Improved water quality in streams and groundwater

The general basin strategy is discussed in chapter XI. Specific additional non-point efforts that should be made in the basin include a detailed inventory of saline seep areas to determine the extent and impact of saline seeps on water quality. Upon completion of a saline seep study, a program should be implemented to control or abate problems created by saline seeps.

The other non-point pollution problem in the basin is poor qualities of water associated with irrigation return flows. These return flows impact both receiving streams and groundwater due to seepage of irrigation systems.

An inventory of irrigation return flows is needed. Results of this investigation would be used to establish and implement a correction and abatement program.

VII. SURFACE WATER RESOURCES

The Lower Missouri River basin contains four major sub-basins (Figure 1 and Plate I):

1. Redwater River from its source in the mountains southwest of Brockway to its mouth into the Missouri River.

2. Poplar River from where the east fork and west fork cross the international boundary from Canada to the United States to its mouth into the Missouri River.

3. Missouri River main stem, Wolf Creek, and several intermittent streams draining into the Missouri River from Fort Peck Dam to the North Dakota-Montana boundary.

4. Beaver Creek, Whitetail Creek, and Big Muddy Creek from the confluence of Beaver Creek and Whitetail Creek to the mouth of Big Muddy Creek into the Missouri River

The Lower Missouri River and its major tributaries in the basin are shown schematically in Figure 3. In the Lower Missouri River basin, the U. S. Geological Survey has had 42 stream gaging stations, of which 20 remain active (Figure 1 and Plate I). U. S. Geological Survey data for gaging stations in the study basin are summarized in Table 12. Other gaging stations exist on these waters but are located outside of the study area in Canada and North Dakota.

Stream flows in the Lower Missouri River basin are affected by local weather conditions, geology, reservoirs and irrigation (Table 13). A major part of flow occurs during spring runoff; March through early July is the most common snow-melt period, but warm weather in mid-winter can produce significant short-term increases in stream flows. Stream flows of the Redwater River, the Poplar River, and Big Muddy Creek reflect the snow-melt increases in flow, but stream flows of the Missouri River main stem are regulated by Fort Peck Dam.

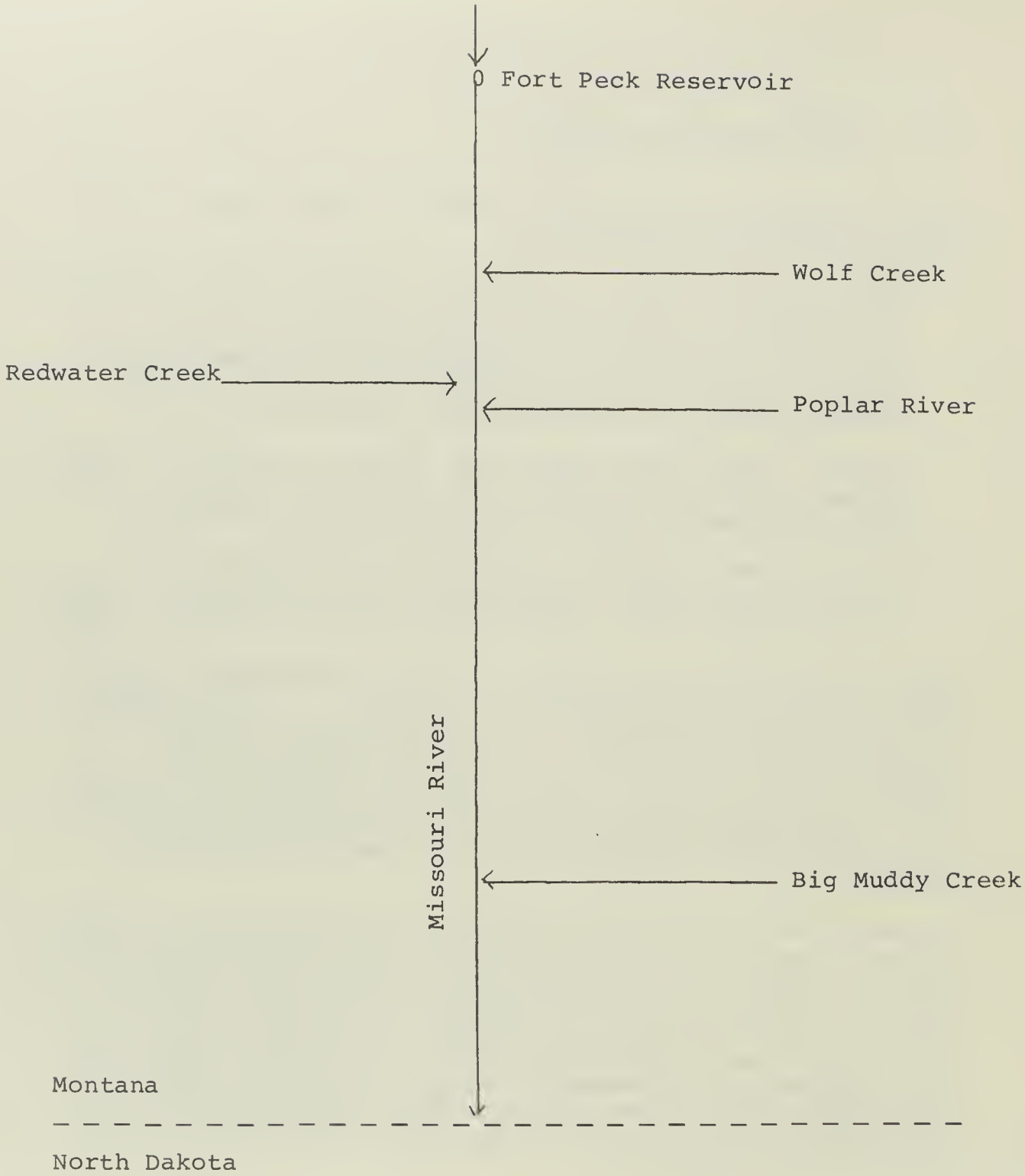

FIGURE 3. SCHEMATIC DIAGRAM OF STREAMS IN THE LOWER MISSOURI RIVER BASIN

TABLE 12. SUMMARY OF U. S. GEOLOGICAL SURVEY STREAM FLOW GAGING STATION DATA
(Partial Record Stations not Included)

Station Name and USGS No.	Location	Minimum streamflow (cfs) Instantaneous	Minimum streamflow (cfs) Daily	7-day, 10-year Low Flow (cfs)	Average Annual Flow (cfs)	Period of Record
Missouri River below Ft. Peck Dam, MT, 0613200	T26NR42E06B	-	7,400	not determined	9,551	March 1934 to present
Missouri River Main Stem near Wolf Point, MT 06177000	T27NR48E28BC	320	6,500	not determined	10,230	1928 to current year
Redwater at Circle, MT 06177500	T19NR38E11CC	0	-	not determined	14.6	April 1929-March 1930 July 1931-December 1932 March-June 1933 April 1937-June 1972 discontinued
Middle Fork Poplar River 06178000	T37NR46E06D	0	-	not determined	not determined	March 1931 to present
Big Muddy Creek at Daleview, MT 06182500	T36NR52E05	0	-	not determined	15.7	August 1947-June 1972 discontinued
Missouri River near Culbertson, MT 06185500	T27NR36E03BD	575	6,800	not determined	9,551	March 1934 to present

TABLE 13. TYPICAL STREAM FLOW DATA FOR LOWER MISSOURI RIVER BASIN
(USGS Water Resources Data - 1972)
Monthly Mean Discharge (cfs) for Water Year 1971 - 1972

Station Name and USGS No.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Total For Year Acre-Feet	*Total for Average Year Acre-Feet
Missouri River below Ft. Peck Dam 06132000	8,439	8,280	9,184	13,460	13,700	10,480	14,020	12,940	9,153	9,077	10,170	8,987	7,730,000	6,920,000
Missouri River near Wolf Point, MT 06177000	8,346	8,196	8,940	13,070	13,090	12,610	14,290	13,320	12,160	9,182	10,560	9,374	8,048,000	7,412,000
Redwater River at Circle, MT 06177500	0.21	0.44	0.15	0.025	0.72	353	5.25	5.82	1.12	---	---	---	9,698.23	10,580
Poplar River Middle Fork 06178000	3.20	---	---	---	---	186	11.[illegible]	27.6	23.4	7.01	1.63	0.66	15,950 Mar. to October	Seasonal flows (long-term average not available)
Big Muddy Creek at Daleview, MT 06182500	0.90	1.41	0.33	0	0	266	8.86	12.2	41.6	---	---	---	---	11,370
Missouri River near Culberton, MT 06185500	8,555	8,267	8.601	12,620	14,200	17,260	14,900	13,960	13,660	9,255	10,960	9,323	8,556,000	7,484,000

*Long-term averages.

VIII. WATER QUALITY

Other than water samples analyzed in this report, water quality has been measured in only two USGS stations in the Lower Missouri River basin (Table 14). Water quality data for streams discussed in this report appear in Table 15.

REDWATER RIVER

Originating as intermittent stream drainages on the northern slopes of the Big Sheep Mountains, the Redwater River flows north and slightly east to the Missouri River. Along this course, agricultural activities consist mostly of grazing and dryland farming. The water is a sodium-sulfate type hard water and has a high specific conductance (Table 15). Water is generally of a poor quality and is unsuitable for irrigation. Water quality, except turbidity, of the Redwater River, as indicated in Table 15, is best near the mouth. However, there is a high fecal coliform count probably caused by livestock. Higher turbidity near the mouth is thought to be from both natural soil erosion and from livestock disturbances of stream banks. Based on limited data collected during this study, dissolved oxygen and temperature of this stream do not violate water quality standards. More detailed studies are needed to determine if lower concentrations of dissolved salts near the mouth is due to groundwater inflow or due to some other phenomenon and to determine the causes for the high fecal coliform and high turbidity.

POPLAR RIVER

Poplar River, east fork and west fork, originate in Canada and flow into the United States. Both tributaries flow in a southeastward direction to where they merge on the Fork Peck Indian Reservation forming the Poplar River main stem, which flows south and slightly east to the Missouri River. Along this stream course, most activities are agricultural, including grazing and dryland farming. The water is a sodium-bicarbonate type hard water and has a high specific conductance.

Limited sampling indicates a high fecal coliform count (Table 15). The stream appeared clear and had a low sediment load. Table 15 also indicates that turbidity, temperature, and dissolved oxygen are not problems; however, water is generally of a poor quality and is reported to be marginally suited for irrigation during some summer months.

MISSOURI RIVER MAIN STEM

The Missouri River main stem below Fort Peck flows from Fort Peck Dam east past Wolf Point, Poplar, Culbertson and into North Dakota. Water flows are regulated by Fort Peck Dam and do not correspond to seasonal climatic conditions. As the land topography along the stream banks is unsuitable for cultivation, grazing is the primary agricultural activity and probably has no significant influence on water quality. Visually, the water has a low sediment load and low turbidity; temperature and dissolved oxygen were measured and were not problems. Limited sampling indicates the water to be of a good quality and does not violate state standards (Table 15).

BIG MUDDY CREEK

Bug Muddy Creek originates at the confluence of Beaver Creek and Whitetail Creek. Whitetail Creek begins as an intermittent stream in the rolling hills north of Flaxville, Montana; and Beaver Creek begins as an intermittent stream in the rolling hills near the Canadian border. After merging to form Big Muddy Creek, the stream source is generally east to Plentywood and then generally south to its mouth at the Missouri River. Along this course, agricultural activities include grazing and dryland farming. The water is a sodium-sulfate type hard water, has a high specific conductance, and limited data indicates it to be high in fecal coliforms (Table 15). Visually, the stream has a high sediment load and high turbidity. Temperature and dissolved oxygen were not problems. Water quality is poor, being relatively high in turbidity, conductivity, bicarbonates, sodium, sulfates, and some metals. Water quality of Big Muddy Creek is best near its mouth. More detailed studies are needed to determine the causes of the sediment load, high turbidity, and to determine if the better quality downstream is due to groundwater infiltration, influences of other streams, or some other phenomenon. Suitability of Muddy Creek for irrigation depends on soil, season, stream flow, plant type, and application rate. Generally, the water is poorly suited for irrigation.

TABLE 14. LOWER MISSOURI RIVER USGS WATER QUALITY STATIONS

Station Name and USGS No.	Location[1]	Period of Record	Sampling Intervals	Water Quality Parameters
Missouri River near Wolf Point 06177000	T27NR48E28BC	March 1949-Sept.1951 Sept. 1961-Sept.1962 July 1956-Sept.1968 Oct. 1969-Sept.1972	Monthly	Temperature (°C), Dissolved SiO_2, Fe, Ca, Mg, Na, K, SO_4, Cl, F, N, P, Solids, Hardness, HCO_3, CO_3, SO_4, Specific Conductance, pH
Missouri River near Culbertson 06185500	T27NR36E03BD	July 1965-Sept.1972	Monthly	Temperature (°C), HCO_3, CO_3, SO_4, N, Total Nitrogen, Total P, BOD, DO, Hardness, Ca, Mg, Specific Conductance, pH, Dissolved SiO_2, Fe, Ca, Mg, Na, K, Solids, Mn, N, P, Cl, F, B

(1) See Appendix C

TABLE 15. LOWER MISSOURI RIVER WATER QUALITY SUMMARY[1]

Temperature - °C
Specific Conductance - µ mho at 25° C
pH - standard units
Dissolved Calcium - Ca
Dissolved Magnesium - Mg
Dissolved Sodium - Na
Dissolved Potassium - K
Bicarbonate - HCO_3

Carbonate - CO_3
Sulfate - SO_4
Chloride - Cl
Fluoride - Fl
Nitrate - NO_3
Ortho Phosphate - PO_4

Values are in mg/l unless otherwise indicated.

FC - Fecal Coliforms/100 ml
[3] TR Manganese - Mn
TR Cadmium - Cd
TR Zinc - Zn
TR Arsenic - As
TR Iron - Fe
TR Copper - Cu
TR Lead - Pb
DO - Dissolved Oxygen

Station and Location[2]	Date Sampled	Temp. °C	pH	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	F	PO_4	FC	Spec. Cond.	Mn	Cd	Zn	As	Fe	Cu	DO	Turbidity JTU
Big Muddy Creek at Co. Road Crossing T36NR52E16D	10-21-74	8.0	8.6	42	46	380	8.5	730	470	0	.09	.22	.06	1000	2003	.04	<.001	<.01	<.001	.87	<.01		25.0
Big Muddy Creek at Hwy. 350 Bridge T31NR55E28A	10-21-74	8.0	9.0	30	78	530	16	652	908	0	.04	.29	2.8	458	2681	5.8	<.001	<.01		3.0	<.01	8.3	120.0
Big Muddy Creek near Mouth T28NR55E28D	10-22-74	2.0	8.4	55	23	69	4	200	180	9.5	.04	.71	.06	308	679	.25	.001	.01		.42	.01	9.9	15.0
Fort Peck after Bay 26N41E	7-10-73	10	8.3	46	19	39		182	118	7.0	.14	.62	.07		584		<.01		<.01	.19	.01		3.3
Lake Creek T32NR58E22C	10-21-74	8	8.0	112	79	175	8.2	524	525	0.8	.29	.30	.09	628	1745		<.001	<.01	.003	.25	.01	11.5	3.0
Missouri River W. of Frazer 26N43E06C	10-22-74	4	8.4	56	10	48	38	190	145	9.0	.04	.70	.03	250	634	.01	<.001	<.01		.17	.01	9.4	4.9
Missouri River at Wolf Point	7-10-73	18	8.5	53	18	44		172	134	7.3	.09	.62	.04		605		.01	1.2	<.01	.03	.02		42
Missouri River at Culbertson T27NR36E03C	10-22-74	2.0	8.4	55	20	45	3.8	182	141	8.0	.04	.72	.06	200	611		<.001	<.01		1.4		9.9	34

(1) Concentrations are in milligrams per liter unless otherwise indicated.
(2) See Appendix C.
(3) TR - Total Recoverable (5 ml concentrated nitric acid added to 1,000 ml of unfiltered sample).

Station and Location	Date Sampled	Temp. °C	pH	Ca	Mg	Na	K	HCO_3	SO_4	Cl	NO_3	F	PO_4	FC	Spec. Cond.	Mn	Cd	Zn	As	Fe	Cu	DO	Turbidity JU
Missouri River near North Dakota line T26N59E22B	10-22-74	3.0	8.4	55	15.3	45	3.8	188	136	8.5	.04	.72	.06	250	610	.26	<.001	<.01		1.6	.01	[illegible]	37.[illegible]
✓ Poplar River at USGS Gage Station T37N46E06A	10-21-74	7.0	8.5	42	44	160	7.9	549	180	0.2	.04	.40	.03	630	1223	.03	.001	<.01	<.001	.87	<.01	8.5	[illegible].4
✓ Poplar River West Fork T37NR42E19C	10-21-74	7.0	9.0	18.4	19.4	178	6.9	433	100	0.5	.26	.41	.03	106	989	.42	<.001	<.01	<.001	.17	<.01	8.4	[illegible]
Redwater River southwest of Brockway at Co. Road T17N46E21B	10-22-74	4.0	8.7	68	457	1960	20	735	5450	0.3	.06	.21	.34	180	8401	.44	<.001	<.01	.021	1.3	.01	8.[illegible]	37
Redwater River at Co. Road near Mouth T27NR50E35A	10-22-74	3.0	8.8	26	49	700	7.5	868	950	0.5	.04	1.5	.03	1178	3203	.48	<.001	.05		2.6	<.01	8.5	72.[illegible]

IX. WASTE DISCHARGE PERMITS

The Montana state program for issuing waste discharge permits is operated under authority of the Montana water pollution control law. Statutory authority to apply and enforce state compliance schedules in state permits are Sections 69-4806(3), 69-4808.2(1)(f)(1) and (2), 69-4820, 69-4820.1, and 69-4823, Revised Codes of Montana, 1947. The applicable rule is existing MAC 16-2.14(10)-S14460, Montana Pollutant Discharge Elimination System (MPDES), Section (2)(b)(ii), effective March 8, 1974. Nine municipal and ten agricultural waste discharge permits have been issued (December 31, 1974) by the state of Montana in the Lower Missouri River basin (Table 16). In addition, four Indian communities have permits drafted that will be issued in the future. Dischargers not assigned a permit number had not made application as of August 31, 1974. All municipalities on compliance schedules are expected to meet secondary treatment requirements by July 1, 1977. Facility description and effluent characteristics are discussed in Section VI.

TABLE 16. MPDES PERMITS IN THE LOWER MISSOURI RIVER BASIN (current as of December 31, 1974)

Facility and Location	MPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule (1)
Bainville 28N 58E 35B	MT 0021865	4-3-74	12-31-76	Immediately
Brockton 28N 53E 28B	MT 0023001	12-22-74	12-31-76	7-1-77
Circle 19N 49E 11D	MT 0020796	5-16-74	12-31-76	9-16-74
Culbertson 28N 56E 22B	MT 0021407	5-16-74	12-31-76	9-16-74
Flaxville 35N 50E 09	No discharge			

(1) Discharge must meet secondary effluent requirements by date specified.

Facility and Location	MPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule (1)
Frazer Water and Sewer Dist. 27N 44E 33B	MT 0021962	No discharge		
Froid 30N 55E 25A	MT 0020192	6-14-74	6-30-76	Immediately
Medicine Lake 32N 56E 25C	MT 0020869	6-14-74	13-31-78	Immediately
Opheim 36N 40E 12D	MT 0020877	No discharge		
Plentywood 35N 55E 19D	MT 0022152	7-11-74	12-31-76	Immediately
Poplar 27N 50E 12D	MT 0021695	12-22-74	6-30-79	7-1-77
Reserve	under investigation			
Richey 22N 52E 19D	MT 0020362	No discharge		
Scobey 35N 48E 16D	MT 0020206	7-11-74	6-30-79	Immediately
Westby 36N 58E 24A	No discharge			
Wolf Point 27N 47E 21B	MT 0020532	12-22-74	12-31-76	Immediately
Fladager Feedlot 35N 45E 10BB	F-9-B	6-11-73		Immediately
Carterline Enterprises 28N 56E 27CA	F-4-H	5-7-73		Immediately
Walkikouis Farms 32N 53E 25AD	MT 0029008	7-3-74		Immediately
Forest H. Brown 30N 51E 33AA	MT 0029026	10-30-74		Immediately
Richardson Swine Operation 34N 55E 02D	F-8-H	6-11-73		Immediately
Hilyard Farms 35N 55E 29A	F-5-H	5-7-73		Immediately

(1) Discharge must meet secondary effluent requirements by date specified.

Facility and Location	MPDES Permit No.	Date Issued	Expiration Date	Compliance Schedule[1]
Thompson Hog Farm 33N 53E 19CA	MT 0029015	7-26-74		Immediately
McCabe Farms, Inc. 31N 56E 19A	MT 0022756	12-30-74		Immediately
Wolf Point Feeders 27N 46E 23AC	MT 0022195	12-30-74		Immediately
Nash Brothers, Inc. 35N 48E 11C	MT 0022233	12-30-74		7-1-75

(1) Discharge must meet secondary effluent requirements by date specified.

Federal permits were issued pursuant to the National Pollutant Discharge Elimination System (NPDES) created by the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA of 1972). To eliminate the duplication of effort which formerly existed, Montana was given the authority to administer the NPDES program in Montana on June 10, 1974. Section 402 of the FWPCAA of 1972 provides that states with adequate water pollution control programs may apply for and receive authority from the EPA to issue permits under the NPDES in their own states. Montana made the necessary revisions to the state water pollution control laws during the 1973 legislative session to provide statutory authority for administration of the NPDES program in Montana. In addition, the Board of Health and Environmental Sciences adopted a rule entitled the Montana Pollutant Discharge Elimination System (MPDES). The MPDES rule provides the additional program elements needed by the state to comply with rules and regulations promulgated by the administrator of EPA pursuant to Section 304(h) of the FWPCAA of 1972. Section 304(h) relates to the state program elements necessary to administer the NPDES program.

X. WASTE LOAD ALLOCATIONS

Limited data collected during this basin study indicate fecal coliform concentrations of Big Muddy Creek, Poplar River, and Redwater River violate state water quality standards. There are no point dischargers in these stream segments; therefore, no waste load allocations are made. The coliform problem is probably created by non-point discharges which were not clearly identified in this investigation.

No streams in this basin are presently classified as effluent limited. Data collected during this investigation suggest that some streams may be water quality limited, but more detailed work is needed to verify this classification. The following streams need further evaluation:

Stream[1]	Segment	Problem(s)
Big Muddy Creek	36N 52E 16D 31N 55E 28A	Salinity, high turbidity, high fecal coliforms, high sediment loads.
Redwater River	26N 50E 18A 27N 50E 35A	Salinity, high turbidity, high fecal coliforms.
Poplar River[2]	37N 46E 06A 35N 49E 06	Salinity, high fecal coliforms.
Lake Creek	32N 58E 24 32N 57E 25	Salinity, high fecal coliforms.

(1) Streams are ranked according to need for further study.

(2) The Water Quality Bureau currently has a proposal in progress for a grant to further examine the Poplar River water quality.

XI. MANAGEMENT AND STRATEGY

A water quality management strategy should be designed to maintain and enhance water quality in the basin. The strategy also must consider requirements of all federal and state laws and regulations. The Federal Water Pollution Control Act Amendments of 1972 provide that for all discharges, other than publicly owned treatment works, not later than July 1, 1977, effluent limitations are to be achieved which represent application of best practicable control technology currently available. By July 1, 1977, publicly owned treatment works will be required to have secondary treatment or any more stringent limitation, including those necessary to meet water quality standards, treatment standards, or schedule of compliance established pursuant to any state law or regulations (under authority prescribed by Section 510) or any federal law or regulations or be required to implement any applicable water quality standard established pursuant to the act.

The Lower Missouri River basin contains 3.8 percent of Montana's population or about 26,680 persons (based on 1970 census). Eleven municipalities plus four Indian communities either discharge or have a potential to discharge to streams within the basin. All dischargers within the basin are minor dischargers. From a basin strategy, management programs or plans can be developed and implemented. After plan development and implementation, water and wastes in the basin must be checked to determine the actual influence of the plan on basin waters. Water quality management is an iterative process; that is, a plan must be followed, the results checked, and the program modified, and the results checked again. In the Lower Missouri River basin, the basic strategy will consist of:

1. Needed municipal sewage treatment works have been ranked according to priority (Section XIII) and will be upgraded to meet secondary treatment standards. This will improve the quality of sewage treatment plant effluents and ensure compliance with Montana water quality standards.

2. Annual operation and maintenance inspection will be made of the municipal sewage treatment facilities.

Critical installations will be provided additional inspections where possible. EPA form 7500-5 will be utilized for operation and maintenance inspections. Facilities needing special assistance on operation and maintenance will be handled on a request basis. Assistance of EPA operation and maintenance personnel will be requested where long-term (two or three weeks) assistance will be required.

3. MPDES and NPDES permits (Section IX) are issued or are pending to all dischargers requiring permits in the Lower Missouri River basin.

4. All municipal discharges under MPDES permit will be monitored by the Water Quality Bureau personnel for compliance with applicable effluent limitations and compliance schedules at least once during fiscal year 1975. In addition, approximately 50 percent of the minor discharges under permit will be monitored for compliance during fiscal year 1975. Suspended residue, BOD_5, fecal coliforms, and flow will be monitored in all municipal discharges; residual chlorine will be measured where chlorination is provided. Municipal water treatment plant discharges will be monitored for aluminum, suspended residue, turbidity, flow, pH, and residual chlorine. MPDES permits are pending for several feedlot operations in the Lower Missouri River basin; and as yet, wastewater discharge limitations have not been developed.

5. It is the goal of the Montana Department of Health and Environmental Sciences to ensure best practical control technology and best available control technology effluent limitations are met by all industrial dischargers by July 1, 1977, and July 1, 1983, respectively, as required by the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, and as further defined by EPA regulations. It is also the goal of the department to achieve no discharge of pollutants to state waters by July 1, 1985.

6. The Lower Missouri River basin plan will be used as the basis for establishing priorities for surveillance, construction grants, and permit issuance.

7. Pollution from saline seeps is considered to be a water pollution problem in Montana and in the basin and should be further studied. Results of present studies will be used to assess the problem, determine potential abatement methods and determine needs for detailed studies.

8. The Water Quality Bureau will participate with other regulatory agencies in controlling land use activities to abate potential and existing pollution problems. Specifically, SJR 0052, a joint resolution of the House and Senate passed by the 1974 legislature states in part:

> NOW, THEREFORE, BE IT RESOLVED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA:
>
> That the Department of Natural Resources and Conservation and the Resource Conservation Advisory Council in cooperation with the Montana Association of Conservation Districts, the Department of Health and Environmental Sciences, and other interested parties make a thorough study of the sediment control problem, and existing legislation, and recommend to the 1975 Legislative Session appropriate legislation, including proposed rules and standards implementing such legislation, establishing a statewide program for the control of soil erosion and sediment damage.

9. Oil spill inspection and reporting will be coordinated with the EPA, Department of Fish and Game, and the Oil and Gas Conservation Division of the Department of Natural Resources and Conservation.

10. Plans for subdivisions within the basin will be reviewed to assure water supplies and sewage disposal facilities are provided which comply with the state subdivision law and regulation. The law and regulation are administered by the Water Quality Bureau. The law requires approval of subdivision plats, plans, and specifications by the Department of Health and Environmental Sciences before filing with the county clerk and recorder.

11. Enforcement action will be taken to protect water quality. Under the state water pollution control law, enforcement remedies are contained in Sections 69-4820, 69-4820.1, 69-4821, 69-4824, 69-4824.1, and 69-4825. Penalty provisions are contained in Section 69-4824.

12. Municipalities, industries, and agricultural dischargers will be required to monitor their own discharges. Frequency and parameters will be in accordance with MPDES permit conditions, and results will be submitted to the Water Quality Bureau and EPA. Authority to apply and enforce state compliance schedules in state permits is discussed in Section IX. Authority to enforce stream water quality standards is discussed in Appendix B.

13. Selected water quality monitoring stations will be continued (Table 17) as a long-range water quality surveillance network.

14. Data for municipal discharges will be collected from the self-monitoring reports that permittees are required to submit to the Water Quality Bureau and Region VIII of EPA. This data will be confirmed by bureau monitoring.

15. Disposal of brine from oilfield operations is controlled by the Montana Oil and Gas Commission.

TABLE 17. LOWER MISSOURI RIVER WATER QUALITY SURVEILLANCE STATIONS

Station Name and Number	Agency	Location(1)	Sampling Intervals	Water Quality Parameters
Missouri River below Ft. Peck Dam 0613200	USGS	T26N R45E 06B	Daily	Temperature, conductivity, flow
			Monthly	HCO_3, CO_3, Ca, Mg, F, Na, K, SiO_2, Turbidity, Fl, SO_4, Dissolved Solids, Total P, Total N, Phyto Plankton, Suspended Sediment, pH, DO, Fecal Coli, Fecal Strep
			Quarterly	DO, Total Metals - As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Si, Zn, TOC - Paraphyton Sample, Chlorophyll Dominant Species
Missouri River near Culbertson, MT 06185500	USGS	T27N R56E 03BD	Daily	Sediment, Temperature, Flow, Conductivity
			Monthly	HCO_3, CO_3, Ca, Mg, F, Na, K, SiO_2, Turbidity, Fl, SO_4, Dissolved Solids, Total P, Total N, Phyto Plankton, Suspended Sediment, pH, DO, Fecal Coli, Fecal Strep
			Quarterly	DO, Total Metals - As, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Si, Zn, TOC, Paraphyton Sample, Chlorophyll Dominant Species

XII. SURVEILLANCE PLAN

A surveillance plan is useful for monitoring existing discharges for compliance with permit conditions, checking instream water quality against Montana's water quality standards and detecting long-term water quality changes in the basin. Therefore, upon completion of the Lower Missouri River Basin Water Quality Inventory and Management Plan, a long-range quality surveillance network will be maintained (Table 17). The principal monitoring effort in fiscal year 1975 will be to identify water quality problems, including effluent discharges. Major streams and problem areas will be sampled and analyzed for major ions, flow, BOD, coliforms, pH, temperature, toxic metals, nutrients, specific conductance, turbidity, and selected additional constituents. As sampling for water quality management is completed, permanent instream stations will be established to provide information on water quality trends.

The state will do a limited amount of monitoring during the year to determine compliance or noncompliance with effluent limitations contained in waste discharge permits. The major portion of the compliance monitoring activities will be undertaken during the second half of fiscal year 1975 because of excessive laboratory loads during the first half of the year resulting from the department's water quality management planning efforts.

The Water Quality Bureau will collect and analyze samples from major industrial and municipal discharges yearly. Approximately 50 percent of the minor municipal discharges will be sampled yearly with the balance sampled in alternate years. Municipalities, industries, and agricultural discharges will be required to monitor their discharges with frequency and parameters to be in accordance with the MPDES and results to be submitted to the Water Quality Bureau and EPA.

During fiscal year 1975, an engineer within the bureau will coordinate enforcement within the bureau. Field personnel located at Billings will be available for providing on-site inspections and investigations. Assistance of the Department of Fish and Game will be solicited and utilized in some investigations. In addition, the bureau will utilize the department's legal unit where legal

action is warranted. EPA has offered the assistance of their legal personnel, and their assistance will be requested where it appears they can better handle the situation.

Two main priorities are:

1. Establish definite uniform procedures and guidelines to be used by the Water Quality Bureau in carrying out administrative and judicial enforcement action.

2. Take necessary action to ensure compliance with permit conditions of all waste discharge permits issued in Montana.

XIII. MUNICIPAL FACILITIES INVESTMENTS

State water quality standards in the Lower Missouri River basin will not be violated by any municipal discharge after the application of secondary treatment. Needs, project costs, and scheduling are summarized in Table 18. Data to evaluate cost effectiveness of treatment needs were not available.

TABLE 18. MUNICIPAL SEWAGE TREATMENT NEEDS IN THE LOWER MISSOURI RIVER BASIN

Community (1)	Needs Description	Cost Estimate	Status
Flaxville	Sewer system	$125,000	Project underway for system and treatment facilities.
Poplar		$425,000	Have $15,750 grant for planning.
Circle	Needs survey	$100,000	Fiscal year 1977

(1) Municipalities are ranked in the order of priority.

XIV. PLANNING NEEDS

Future efforts will be needed in the basin to study a variety of water quality problems and to develop plans for correction and abatement of these problems. Problems that have been identified and are described in this report include saline seep problems, irrigation return flows, and energy impacts due to coal developments. Additional municipal facilities are also needed in the basin (Section XIII).

The Saskatchewan Power Corporation is planning a coal-fired generation station near Coronack, Saskatchewan, and will be altering the Poplar River water quality. The USGS has established a water quality station on the Poplar River at the United States-Canadian border, and the Water Quality Bureau is planning an evaluation of the impact of this development on the area's water quality.

An additional problem in the basin will be the planning, establishment, and operation of water quality and biological monitoring stations. This will be needed to determine changes in water quality in the basin. Special effort should be directed towards study of coliform concentrations in streams which were shown in this investigation to be high in coliform concentrations.

APPENDIX

APPENDIX A

GLOSSARY

Symbol	Definition
NOAA	National Oceanographic and Atmospheric Administration
SCS	U. S. Department of Agriculture, Soil Conservation Service
BR	U. S. Department of the Interior, Bureau of Reclamation
NPDES	National Pollutant Discharge Elimination System
WQB	Montana Department of Health and Environmental Sciences, Environmental Sciences Division, Water Quality Bureau
mgd	million gallons per day
BOD_5	five-day biochemical oxygen demand
gpd	gallons per day
tpd	tons per day
gpm	gallons per minute
mg/l	milligrams per liter
USGS	U. S. Geological Survey
cfs	cubic feet per second
JTU	Jackson Turbidity Units
$\mu\mho$	Micromhos per centimeter
TR	Total recoverable

Symbol	Definition
EPA	U. S. Environmental Protection Agency
$<$	less than
$\sim$	approximately
$\leq$	less than or equal to
ml	milliliter
MPDES	Montana Pollutant Discharge Elimination System

APPENDIX B

MAC 16-2.14(10)-S14480 WATER QUALITY STANDARDS

(1) Policy statement. The following standards are adopted to establish maximum allowable changes in water quality and establish limits for pollutants which affect prescribed beneficial uses of state waters. The department adopts as a rule the policy that best practicable treatment and control of waste, activity and flow is to be provided to maintain dissolved oxygen and overall water quality at the highest possible levels, and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor and other deleterious substances at the lowest possible levels.

(2) Application of standards. The water quality standards are composed of water-use classifications [section (4)], water-use descriptions and specific water quality criteria [section (5)], and general water quality criteria [section (6)].

(a) General water quality criteria apply to all state waters except where in this rule specific water quality criteria are more applicable to a specific water-use classification.

(b) In order to carry out the objective of the rule, existing discharges to state waters shall be brought into compliance with the standards as soon as practicable, and in no case later than three years from the effective date of the rule.

(3) Definitions. Unless statutory definition or the context otherwise requires in this rule:

"Conduit" means any artificial or natural duct, either open or closed, for conveying liquids or other fluids.

"Dewatered stream" means a perennial or intermittent stream whose water has been removed for one or more beneficial uses.

"EPA" means the U. S. Environmental Protection Agency.

"Intermittent stream" means a stream or portion of a stream that flows only in direct response to precipitation; it receives little or no water from springs and no long-continued supply from melting snow or other sources.

"Naturally occurring" means conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Conditions resulting from dams in existence as of July 1, 1971 are natural.

"Mixing zone" means that volume of state water wherein any pollutant may exceed allowable water quality standards.

"Pesticide" means insecticides, herbicides, rodenticides, fungicides or any substance or mixture of substances intended for preventing, destroying, controlling, repelling, altering life processes, or mitigating any insects, rodents, nematodes, fungi, weeds and other forms of plant or animal life.

"Residue" means oils, floating solids and sludge deposits.

"Sediment" means solid material settled from suspension in a liquid; mineral or organic solid material that is being transported or has been moved from its site of origin by air, water or ice and has come to rest on the earth's surface, either above or below sea level; or inorganic or organic particles originating from weathering, chemical precipitation or biological activity.

"Settleable solids" means inorganic or organic particles that are being transported or have been transported by water from the site or sites of origin and are settled or are capable of being settled from suspension.

"Sewer" means a pipe or conduit that carries wastewater or drainage water.

"State waters" means any body of water, irrigation system or drainage system, either surface or underground. This section shall not apply to irrigation waters where the waters are used up within the irrigation system and said waters are not returned to any other state waters. The term "state waters" as used in this rule does not include underground water.

"Storm sewer" or "storm drain" means a sewer that carries storm water and surface water, street wash and other wash waters, or drainage but excludes sewage and industrial wastes.

"True color" means the color of water from which the turbidity has been removed.

"Turbidity" means a condition in water or wastewater caused by the presence of suspended matter resulting in the scattering and absorption of light rays.

(4) Water-use classifications.

Missouri River drainage from Rainbow Dam in Great Falls to the North Dakota state line except the portion of the mainstem and the tributaries listed below . . . . . B-D_3

Missouri River (mainstem) from Fort Peck Dam to the Milk River . . . . . B-D_2

Wolf Creek drainage near Wolf Point . . . . . B-D_2

Poplar River drainage . . . . . B-D_2

(e) B-D_2 classification.

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 7.0 milligrams per liter from October 1 through June 1 nor below 6.0 milligrams per liter from June 2 through September 30.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 is to be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions; also, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(f) B-D3 classification.

(i) Water-use description. The quality is to be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming and recreation; growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(ii) Specific water quality criteria.

(aa) The average number of organisms in the fecal coliform group is not to exceed 200 per 100 milliliters nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters. The average number of organisms in the coliform group is not to exceed 1,000 per 100 milliliters nor are 20 percent of the samples to exceed 1,000 coliforms per 100 milliliters during any 30-day period.

(ab) Dissolved oxygen concentration is not to be reduced below 5.0 milligrams per liter.

(ac) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 is to be less than 0.5 pH unit. Natural pH outside this range is to be maintained without change. Natural pH above 7.0 shall be maintained above 7.0.

(ad) The maximum allowable increase above naturally occurring turbidity is 10 Jackson Candle Units, except as is permitted in the general water quality criteria.

(ae) A 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 77° F; within the naturally occurring range of 77° F to 79.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 80° F; and where the naturally occurring

water temperature is 79.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

This applies to all waters in the state classified B-D3, except from the Billings water supply intake to the water diversion at Intake, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 79° F; within the range of 79° F to 81.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 82° F; and where the naturally occurring water temperature is 81.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

From the water diversion at Intake to the North Dakota state line, a 3° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 82° F; within the range of 82° F to 84.5° F, no thermal discharge is allowed which will cause the water temperature to exceed 85° F; and where the naturally occurring water temperature is 84.5° F or greater, the maximum allowable increase in water temperature is 0.5° F.

(af) No increases above naturally occurring concentrations of sediment, settleable solids or residues, which adversely affect the use indicated, are allowed.

(ag) Concentrations of toxic or other deleterious substances, pesticides and organic and inorganic materials including heavy metals, after treatment for domestic use, are not to exceed the recommended limits contained in the 1962 U. S. Public Health Service Drinking Water Standards or subsequent editions; also, maximum allowable concentrations are to be less than acute or chronic problem levels as revealed by bioassay or other methods.

(ah) True color is not to be increased more than five units above naturally occurring color.

(6) General water quality criteria.

(a) The degree of waste treatment required to restore and maintain the standards is to be determined by the department and is to be based on the following.

(i) The state's policy of nondegradation of existing high water quality as described in Section 69-4808.2, R.C.M. 1947.

(ii) Present and anticipated beneficial uses of the receiving water.

(iii) The quality and nature of flow of the receiving water.

(iv) The quantity and quality of the sewage, industrial waste or other waste to be treated.

(v) The presence or absence of other sources of pollution on the same watershed.

(b) Sewage is to receive a minimum of secondary treatment as defined by EPA in accordance with requirements as set forth in the Federal Water Pollution Control Act Amendments of 1972.

(c) Industrial waste is to receive, as a minimum, treatment equivalent to the best practicable control technology currently available (BPCT) as defined by EPA. In cases where BPCT is not defined by EPA, industrial waste is to receive, after maximum practicable in-plant control, a minimum of secondary treatment or equivalent.

(d) For design of disposal systems, stream flow dilution requirements are to be based on minimum consecutive seven-day average flow which may be expected to occur on the average of once in ten years. When dilution flows are less than the above design flow at a point discharge, the discharge is to be governed by the permit conditions developed for the discharge through the waste discharge permit program.

(e) State surface waters are to be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will:

(i) Settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines.

(ii) Create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials.

(iii) Produce odors, colors or other conditions as to create a nuisance or render undesirable tastes to fish flesh or make fish inedible.

(iv) Create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life.

(v) Create conditions which produce undesirable aquatic life.

(f) No wastes are to be discharged and no activities conducted such that the wastes or activities, either alone or in combination with other wastes or activities, will violate, or can reasonably be expected to violate, any of the standards; (e.g., in a reach of stream classified B-D_1, the total allowable cumulative increase to naturally occurring turbidity conditions in the reach is 5 Jackson Candle Units).

(g) No wastes are to be discharged and no activities conducted which, either alone or in combination with other wastes or activities, will cause turbidities to exceed those allowed by specific water quality criteria; provided, short-term activities necessary to accommodate essential dredging, channel or bank alterations, stream diversions or other construction where turbidities in excess of the criteria are unavoidable, may be authorized by the department under conditions as it may prescribe.

(h) Methods of sample collection, preservation and analysis used to determine compliance with the standards are to be in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association or in accordance with tests or procedures that have been found to be equally or more applicable.

(i) For operations of existing water impoundments that cause conditions harmful to prescribed beneficial uses of state waters, it is to be demonstrated to the satisfaction of the department that continued operations will be done in the best practicable manner to minimize harmful effects and will not violate state laws or department rules. New water impoundments shall be designed to provide temperature variations in discharging water that maintain or enhance the existing propagating fishery and associated aquatic life. As a guide, the following temperature variations are recommended: Continuously less than 40° F during the months of January and February, and continuously greater than 44° F during the months of June through September.

(j) Ponds for waste treatment purposes are not to be located in drainage ways where the volume of drainage water from a 10-year storm entering the ponds exceeds one-half the volume of the pond; provided that, subject to approval by the department as to design and maintenance, ponds located in drainage ways for the express purpose of containing emergency oil spills are permitted.

(k) Dumping of snow from municipal and/or parking lot snow removal activities into waters of the state is prohibited without a permit from the department.

(l) Existing discharges to state waters will be entitled a mixing zone as determined by the department.

(m) Until such time as minimum stream flows are established for dewatered streams, the minimum treatment requirements for discharges to dewatered receiving streams are to be no less than the minimum treatment requirements prescribed.

(n) Treatment requirements for discharges to intermittent streams are to be no less than the minimum treatment requirements prescribed.

(o) Pollution resulting from storm drainage, storm sewer discharges, and non-point sources, including irrigation practices, road building, construction, logging practices, overgrazing and other practices, are to be eliminated or minimized as ordered by the department.

(p) Application of pesticides in or adjacent to state waters is to be in compliance with the labeled direction, and in accordance with provisions of the Montana Pesticides Act (Title 27, Chapter 2, R.C.M. 1947) and the Federal Environmental Pesticides Control Act (Public Law 92-516). Excess pesticides and pesticide containers are not to be disposed of in a manner or in a location where they are likely to pollute state waters.

(q) The following radiological criteria shall apply to all waters except those classified as A-Closed:

(i) The average dissolved concentrations (including the naturally occurring or background contribution) of iodine 131, radium-226, strontium-89, strontium-90 and tritium are not to exceed the following concentration limits:

Iodine-131	5 pCi/L
Radium-226	1 pCi/L
Strontium-89	100 pCi/L
Strontium-90	10 pCi/L
Tritium	3,000 pCi/L

For all other radionuclides, the average dissolved concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water for continuous occupational exposure as recommended by the National Committee on Radiation Protection (National Bureau of Standards Handbook 69 or subsequent revisions.)

(ii) For a mixture of radionuclides, the following relationship is to be satisfied:

$$\frac{C_1}{L_1} + \frac{C_2}{L_2} \cdot \cdot \cdot + \frac{C_n}{L_n} \leq 1.00$$

C denotes the average concentration of the respective radionuclide, and L denotes its concentration limit.

(iii) Where alpha emitters, strontium-90, radium-228, iodine-129, iodine-130 and lead-210 are known to be absent, routine analyses for dissolved gross beta radioactivity (excluding potassium-40 contribution) may be employed to monitor and show compliance with this criterion (except for tritium) as long as the gross concentration does not exceed 100 pCi/L. When these conditions are not met, routine quantitative analyses of individual radionuclides are to be performed to show compliance. Except in cases where tritium from other than natural sources is known to be absent, routine tritium analyses are to be performed to show compliance. (Note: "Absence" means a negligibly small fraction of the specific concentration limit, where the limit for unidentified alpha emitters is taken as the limit for radium-226.)

(iv) For radionuclides associated with suspended material in transport, the average concentration limits are to be 1/150 of the corresponding maximum permissible concentration in water (insoluble form) for continuous occupational exposure as recommended by the National Committee on Radiation Protection. In-stream sedimentation of these materials is not to produce solids beds that are not in compliance with subsections (q) (i) and (q) (ii) (because of leaching) and/or excessive accumulation in native flora and fauna.

(v) Average concentrations are to be computed from monitoring data acquired during the previous 12 months; maximum concentrations are not to exceed three times the average concentration limits specified.

(vi) Variances from concentration limits specified will be permitted only if the contributing source is non-controllable or a natural source. Best available treatment must be provided for man-made discharges, and the exposure received by affected population groups must be within established dose limits.

(r) No wastes are to be discharged and no activities conducted which, either alone or in combination with other wastes or activities, will result in the dissolved gas content relative to the water surface to exceed 110 percent of saturation.

(s) Bioassay median tolerance concentrations are to be based on latest available research results for the materials, by bioassay tests procedures for simulating actual stream conditions as set forth in the latest edition of Standard Methods for the Examination of Water and Wastewater published by the American Public Health Association, or in accordance with tests or analytical procedures that have been found to be equal or more applicable by EPA. Bioassay studies are to be made using the most sensitive local species and life stages of economic or ecological importance; provided other species whose relative sensitivity is known may be used when there is difficulty in providing the most sensitive species in sufficient numbers.

When specific application factors are not available, the factor is to be determined by using methods listed in Water Quality Criteria published by the Federal Water Pollution Control Administration (1968), or by using other methods accepted as equal or applicable by EPA.

(t) Metal limits for the Clark Fork River (mainstem) from the confluence of Warm Springs Creek to the confluence with Cottonwood Creek are:

Material	Average Daily Concentration ug/l	Maximum Instantaneous Concentration ug/l
Total copper	90	180
Dissolved copper	30	40
Total zinc	300	1,000
Dissolved zinc	80	140
Total iron	1,300	2,200
Dissolved iron	150	160
Total lead	100	100
Dissolved lead	100	100
Total cadmium	10	10
Total arsenic	10	16
Total mercury	1	1

Metal limits for Clark Fork River (mainstem) from the confluence of Cottonwood Creek to the Idaho state line are:

Material	Average Daily Concentration ug/l	Maximum Instantaneous Concentration ug/l
Total copper	50	90
Dissolved copper	30	30
Total zinc	100	200
Dissolved zinc	70	80
Total iron	300	1,300
Dissolved iron	150	150
Total lead	50	50
Dissolved lead	50	50
Total cadmium	10	10
Total arsenic	10	10
Total mercury	1	1

(History: Sec. 69-4814, R.C.M. 1947; IMP Sec. 69-4808.2(1)(b), R.C.M. 1947; Order MAC No. 16-1; Adp. 12/31/72; Eff. 12/31/72; AMD, MAC Notice No. 16-2-3, Order MAC No. 16-2-5; Adp. 7/13/73; Eff. 11/4/73; PRIOR p. 16-375; AMD, MAC Notice No. 16-2-31; Order MAC No. 16-2-11; Adp. 7/19/74; Eff. 9/5/74; PRIOR p. 16-387, 391, 393, 393.1, 393.4.).

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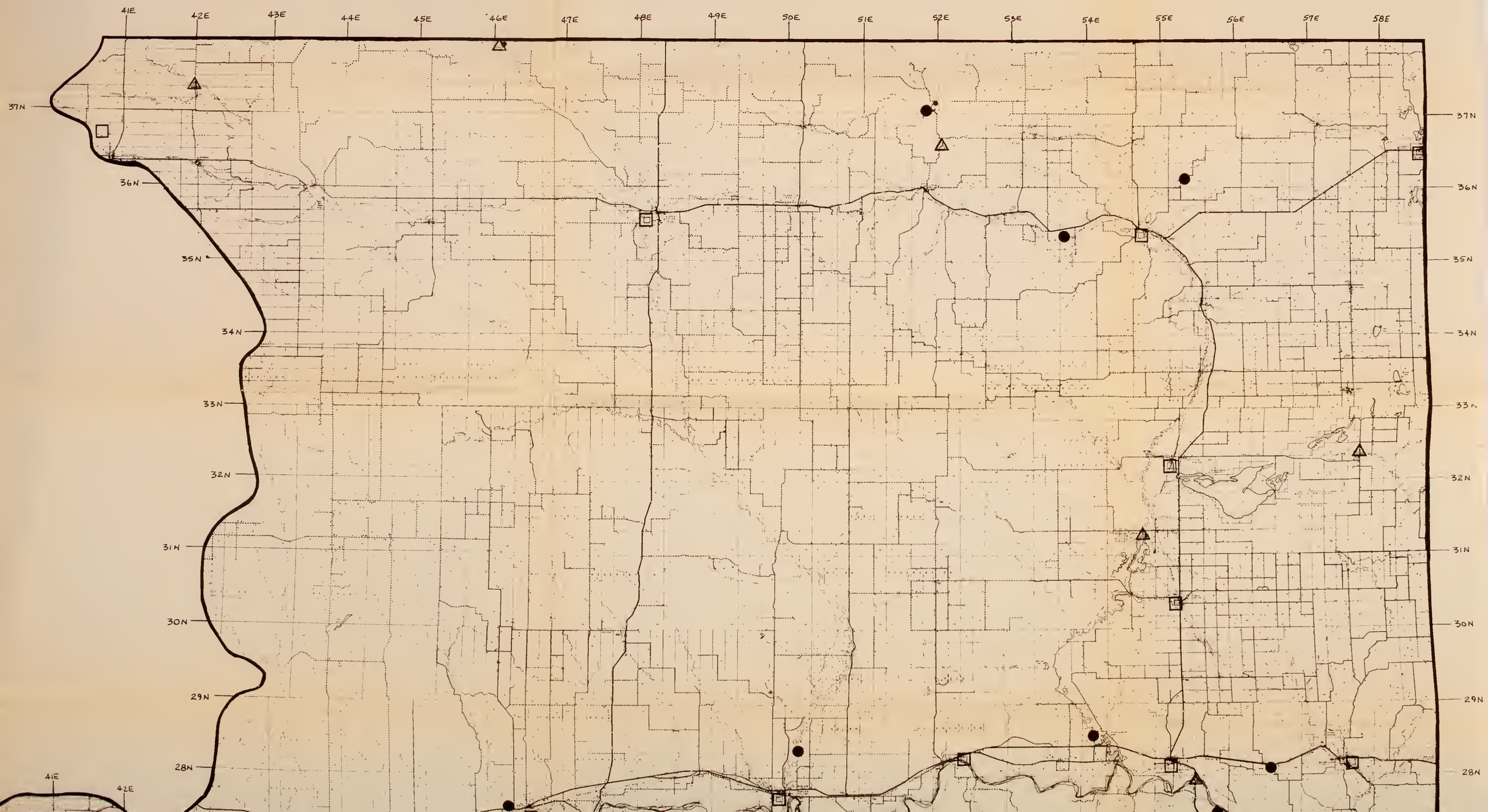
LOWER MISSOURI RIVER BASIN



WATER QUALITY BUREAU
STATE DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
EXPLANATION
PAVED ROADS
UNIMPROVED ROADS
RAILROADS
STATE BOUNDARY
COUNTY BOUNDARY
PERENNIAL STREAM
INTERMITTENT STREAM
WATER QUALITY SAMPLING SITE
STREAM FLOW GAGING STATION
SEWAGE TREATMENT PLANT
SEWAGE TREATMENT LAGOON
WATER TREATMENT PLANT
INDUSTRIAL WATER DISCHARGE
0 2 4 6 8 10
SCALE: 1/4" = 1 MILE
NOTE: THIS MAP WAS COMPILED FROM THE MONTANA STATE HIGHWAY DEPARTMENT COUNTY MAP SHEETS.
N
27N
26N
25N
24N
23N
22N
21N
20N
19N
18N
17N
16N
41E
42E
43E
45E
46E
47E
48E
49E
50E
51E
52E
53E
54E
55E
56E
57E
58E
59E